EDITORIAL

IN writing this editorial, I face the saddest task in 20 years of association with "Radio, Television and Hobbies."

I have to record the death of the editor, John Murray Moyle.

For any journal, loss of the editor is a serious organisational blow, but it often has little impact on the readers. The editor is a symbol rather than a personality.

It has never been that way with "Radio, Television and Hobbies." From the very first issue in April, 1939, the aim has been to establish and maintain a personal link between the editor and his staff, the readers who support the journal and the radio trade, on which it is based. John has been the architect and guardian of this policy through the years and his passing will be felt as a personal loss by all who knew him, either by contact or through his writings.

Having worked alongside him for 20 years, I cannot speak too highly of his devotion to the task in hand, his unique abilities as a writer, his appreciation of music, his technical knowledge and, through it all, his complete unselfishness.

Fittingly enough, the last big job John was able to do was to represent his fellow amateurs at the I.T.U. conference in Geneva. Though, even then, a sick man, he played a very big part in rallying support for the amateur cause.

From Geneva, he returned directly to hospital in Sydney and then to his home, to await the end which he knew was inevitable. John died peacefully in his sleep on Thursday night, March 10. The last words he said to me were words of courage indeed: "She's up, boy. The tail's right up."

There is something poignant about the fact that John passed away as we put this issue to press—our twenty-first birthday issue and the largest ever to have been produced. It carries what has become his farewell article but, more than that, it carries the stamp of his personality.

A good friend has passed on.

W. N. Williams

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RADIO ★★ TELEVISION AND HOBBIES

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OUR COVER PICTURE

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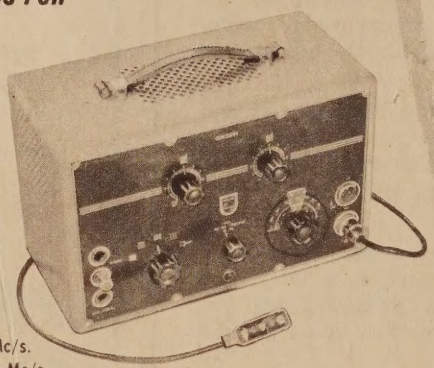

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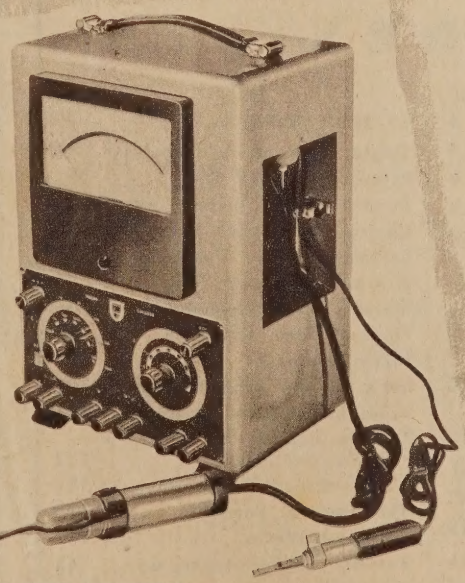

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APPLICATION
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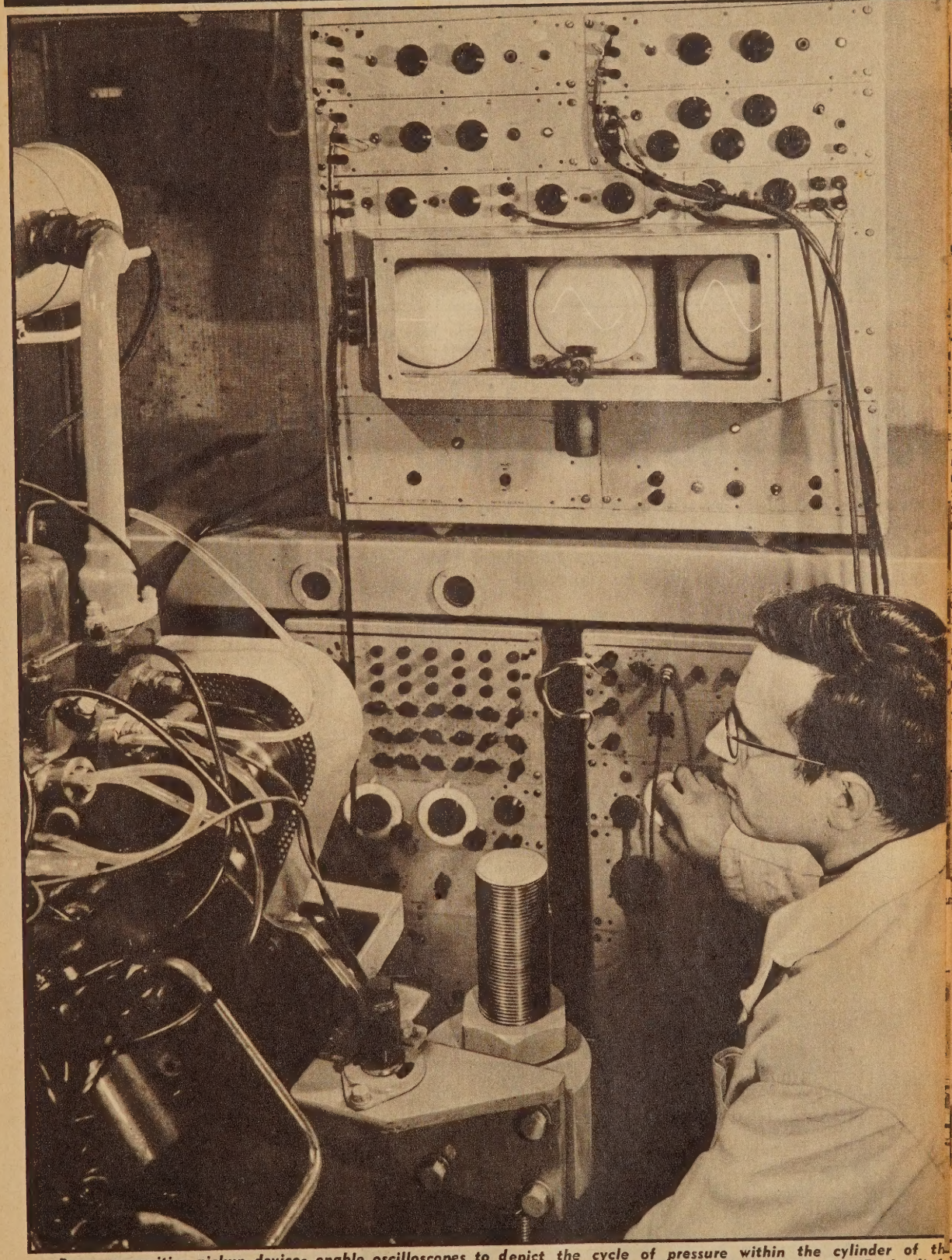
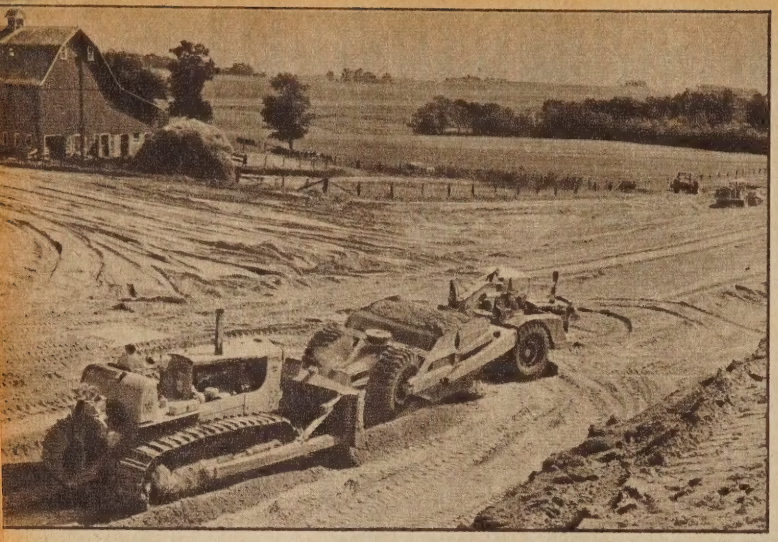
CHECKING ENGINE PERFORMANCE



Pressure-sensitive pickup devices enable oscilloscopes to depict the cycle of pressure within the cylinder of th gasoline engine. With a compression ratio of 12:1, it is installed at the Thornton Research Centre (England) f the investigation of combustion processes.



Seeming chaos precedes a new order. Modern machines can take over the work of up to 1000 men, using manual methods.

Electronics Builds New Roads

The twentieth century ushered in the age of the motor car. Now the insistent demand of motorists for expanded and improved networks is showing up in great road building programs around the world. Never before has there been such emphasis on mobility and the need for better facilities to handle the ever-growing volume of motor traffic.

By R. MICHEL

ETWEEN 1950 and 1960, motor traffic on American highways ıbled, and in Australia it rose even re, proportionately.

Road-building is news today in many ntries. For the most advanced ions and for lands where modern elopments have as yet made relatively ittle impact, the clamour for new or er roads seems almost equally int.

'or Australia, as the world's third it motorised nation, roads are vital, there is constant pressure for imvement of existing roads and for the nsion of the all-weather road netk.

The same sort of need was reflected in the decision taken at last year's conference in Brisbane of the Economic Commission for Asia and the Far East, whereby the countries of South-East Asia have agreed upon a plan to build a great trunk road through the area.

The Highways Committee of ECAFE recommended a 5,000-mile highway to run from Indo-China to Persia, forming a great trunk route, with each member government bearing the cost of the section of road traversing its country.

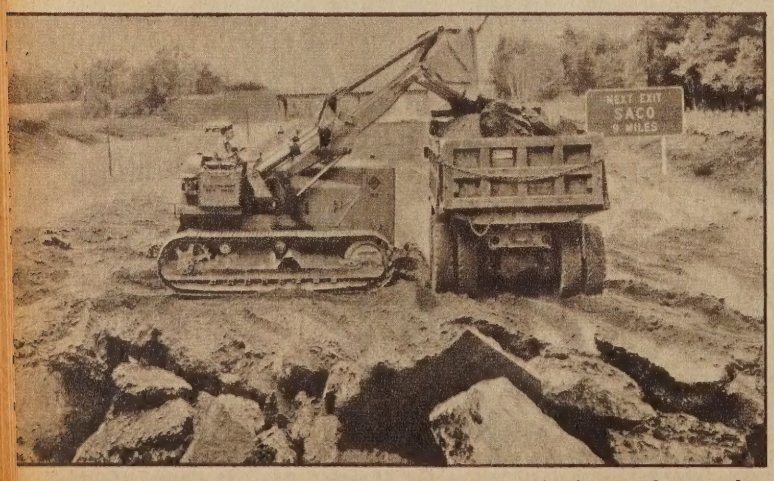
Meanwhile, road-building has become a precise science, and has reached a stage where it brings electronics as well as the largest power shovels into use.

There is no sharp distinction between a road and a highway, but vehicular routes of secondary importance are more often referred to as highways. The term highway was first applied to the type of road built in England by the Romans, who threw up earth from ditches to form a raised, or high, way of travel.

The oldest long-distance road described by historians spanned about 1,750 miles across Asia Minor from the Mediterranean to the Persian Gulf. Starting at Smyrna and Ephesus, it went through to Asia. It was described by an ancient writer as having been paved with brick laid in a mortar of asphalt.

EARLIEST ROADS

It is said that thousands of citizens of Nineveh set up shops and built homes along the road and eventually traffic on it slowed to a snail's pace. Finally it had to be decreed that anyone whose property encroached on the road's right-of-way would be put to death.



diesel tractor, with scoop, makes short work of loading a big truck during construction of a new turnpike, in Maine, U.S.A.

The earliest long-distance roads in Europe were probably the so-called Amber roads, dating from before 2000 B.C., and used to transport amber from the Baltic Sea.

For more than eight centuries preceding the fall of the Roman Empire in the West (A.D. 476) caravans plied the "silk route," between Shanghai, in China, and Europe, and an interchange of goods and knowledge took place along it.

Between China and the Mediterranean the route was known as the Silk Road; in China it was the Imperial Highway and was protected by the Great Wall with its watchtowers and guards at regular intervals.

The greatest of all ancient road builders were the Romans, who understood the importance of communications in holding together an empire. They acquired a knowledge of road-building methods superior to any in use earlier, realising the importance of a thick layer of material that would not be softened by rainfall. They also developed useful surveying instruments. For workers they had slaves and as supervisors they were able to use soldiers.

The great Roman military roads, built between the fourth century B.C. and A.D. 400, covered more than 50,000 miles.

THE APPIAN WAY

The finest of the Roman roads, the Appian Way, extended 366 miles from Rome to the heel of Italy, where ships from the eastern Mediterranean docked. Over it flowed the commerce of all Italy south of Rome.

The Appian Way was built after 312

B.C. by excavating a trench in the natural soil, tamping the soil to firm it, and adding four layers of material—a layer of large flat stones, 10 to 24in in thickness, a course of smaller stones mixed with lime, then a thick layer of small gravel and coarse sand mixed with lime, and finally a wearing surface of hard lava about 6in deep. Total thickness was 3 to 5ft, and widths ranged up to 35ft.

With the decay of the Roman Empire and transfer of power to Constantinople in A.D. 330, the Roman roads began a slow deterioration. By 500 B.C. the barbarians had demoralised travel on the roads in the west and, for some centuries, danger of attack by outlaws discouraged long-distance travel by land.

Throughout the Middle Ages little road-building was undertaken.

By the sixteenth century, however, wheeled vehicles began to reappear on the highways. Denser populations, improved conveyances, and a desire for trade of more than local range brought about the construction of toll roads (or turnpikes).

Thus was ushered in the great coaching age of the seventeenth and eighteenth centuries. In England after 1663 companies were set up to improve roads and charge a toll for their use.

SAME FUNDAMENTALS

This period produced two men who are perhaps the fathers of modern road building — Pierre Tresagnet in France (1716-1797) and John Metcalf in England (1717-1760), both of whom applied fundamental principles that are still accepted by modern road builders.

Two other names, both of Scotsmen, have high places in the history of road construction. Thomas Telford (1757-1834) became famous as a builder of stone bridges and also for excellent broken stone roads, while John London McAdam (1756-1836) obtained wide acceptance for the broken stone road called macadam — though he was not actually the first to use this method.

McAdam insisted on elevation of the road bed, with side ditches, for drainage, and a covering of broken stone on the rounded and compacted subgrade.

In the early part of the nineteenth century, roads in Europe, Britain and the Americas were busy with post riders, stage coaches and waggons. Then, beginning about the 1830s', highways tended to decline in importance as railways spread.

In Australia, construction of roads was one of the main accomplishments of the early governors. By about 1850, however, the available labour force had dwindled and responsibility for road maintenance passed to local administrators. What had been, by the standards of that day, a good though limited road system, went into decline, and this deterioration was accelerated by the spread of the rail system.

Roads as main routes became of secondary importance and road development became largely confined to provision of feeder roads to the railways. Unmade bush tracks carried the bullock waggons of the settlers and the stage coaches of Cobb and Co.

Following World War I, road construction began to re-emerge in Australia as a major form of public works. With the striking advances in the automotive industries, road building came as a complementary factor.

Elsewhere, highways also were re-establishing themselves as the motor age

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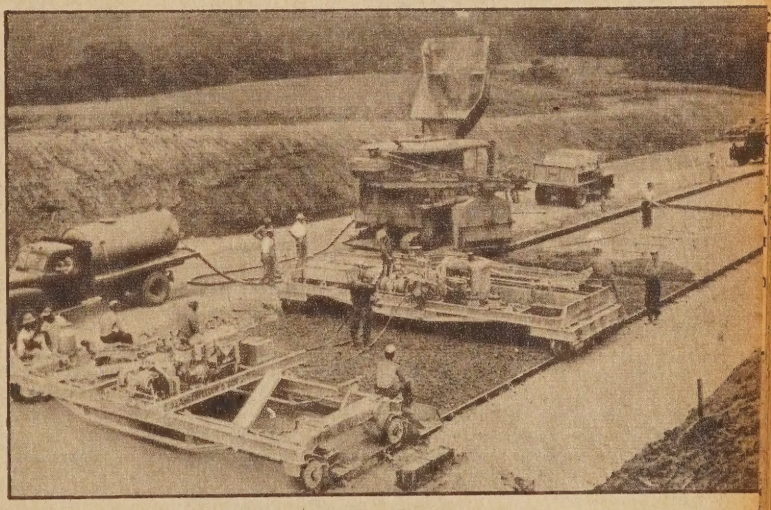
With this "Multifoote paver," 1700 linear feet of pavement 24ft. wide can be laid in a 10-hour day.



This giant machine receives truckloads of gravel, cement and sand, pou mixed concrete on to road bed. A levelling machine follows.

In the wake of the machine workmen put finishing touches to the 535-n superhighway stretching across Buffalo State.

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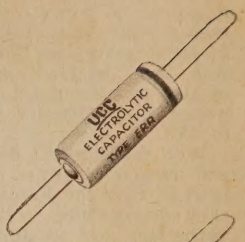

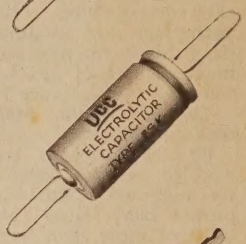

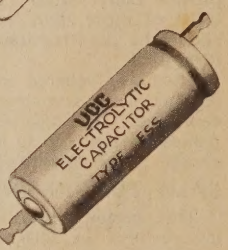

TECHNICAL DATA

CAPACITANCE TOLERANCE:
0 to 100 volts — 10% + 100% 101 volts and over — 10% + 50%

POWER FACTOR:
0 to 100 volts inclusive 30% at 100 cycles per second.
101 volts and over 15% at 100 cycles per second.

WORKING VOLTAGE:
This is the sum of the D.C. voltage and A.C. ripple voltage which can be applied to the capacitor for continuous operation.

PEAK RIPPLE VOLTAGE:
Is the instantaneous value of A.C. voltage across the capacitor caused by the A.C. component. This voltage, as a rule, should not exceed 6% of the rated peak working voltage at 100 cycles per second or 12% of the rated peak working voltage at 50 cycles per second.

PEAK OR SURGE VOLTAGE:
Is the maximum voltage the capacitor will withstand without damage when connected in series with the resistor having a value of $\frac{20,000}{C}$ ohms for 30 seconds: the voltage is measured across the resistor/capacitor combination.

LEAKAGE CURRENT:
All ER and ES type electrolytic capacitors have a finite leakage current. When first connected to a power source the charging current is high, but rapidly drops to a normal value as given by the formula:

$$I = \left(\frac{CV}{10} + 100\right) \mu A,$$

C = Capacity in microfarads.
V = Working voltage.
I = Current in microamperes.

It should be noted that the leakage current given by this formula is the maximum acceptable for satisfactory performance and is normally less than half this value. All readings should be taken at 25°C. after applying the working voltage for five minutes; plus one minute for every month of shelf-storage.

TEMPERATURE:
The effect of temperature is important and it is closely related to and affects all characteristics. The ratings of type ER and ES electrolytic capacitors are based on a maximum temperature of 85°C. The temperature co-efficients of capacity and leakage current are positive whilst that of the power factor is negative.

SHELF-LIFE:
Idle storage has a deteriorating effect on the anode film and should electrolytic capacitors be stored for any length of time they should be re-aged. This is most easily accomplished by applying 90% of the rated voltage to the capacitor in series with a 10,000 ohm heavy duty resistor.

Initially due to a high leakage current the voltage applied to the capacitor will be low, gradually increasing as the current decreases. When the leakage current reaches the rated value the capacitor is ready for use.

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changed the scene. By the 1930's road building was receiving more attention than ever before throughout the world.

Today there are about 525,000 miles of roads used for general traffic in Australia. Of these, about 150,000 miles are surfaced and 145,000 formed clay, while the remainder are merely cleared tracks.

The Commonwealth Government approved a five-year program in 1959 to increase Federal aid to the States for the construction, reconstruction and maintenance of roads. The amount to be made available under this arrangement, beginning on July 1, 1959, is to be £250 million, together with a further £30 million of Federal aid on the basis of a £ for every £ allocated by State Governments from their own resources, additional to the allocations in 1958-59.

This means that more than £750 million of Federal, State and local government finance will be spent on roads over the next five years. In a report presented in January, the Australian Transport Advisory Council outlined the planning in all States.

NEED FOR TRUNK ROADS

Growing weight of traffic over much of the busy road system of south-eastern Australia has shown up inadequacies, and the need for trunk roads able to cope with denser traffic and heavier loads has been clearly shown.

In the more remote areas, other factors are thrown into sharper relief. In the northern areas, almost every aspect of development is so dependent upon transport that all-weather roads are becoming a prerequisite to virtually any other plans. The part road vehicles are playing in transporting cattle, wool and stores is steadily increasing.

Road building and maintenance in these areas present definite and specific problems. Transport, higher wages and climatic conditions all help to increase the cost. Engineers estimate that road work in the north-west cost half as much again as in the southern States.

After survey work, the next stage is to grade and then stabilise and blend materials for the road — at a cost of about £2,500 a mile. The second phase is to deal with the multitude of intermittent rivers and creeks over which concrete causeways are constructed. The third phase is to seal the road and build the bridges.

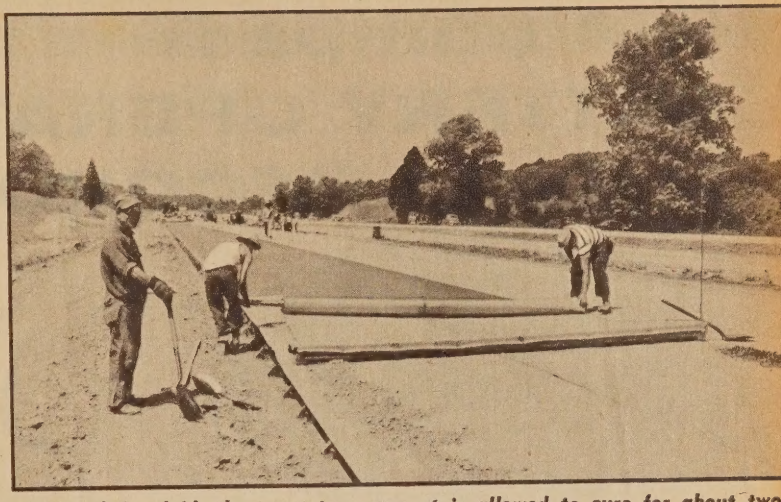
The grading and stabilising of those roads is the main feature of road gangs' work. Sand and clay blended on roads and set in water gives earth roads stability but does not stop the majority becoming muddy in the wet season.

The blending of local materials is preferred to the laying of a straight gravel top which becomes harsh on the surface in the dry period. Materials used in road construction of this nature may be found at the site, but water is short, and many catchment areas have been built along the road.

These are the problems to be faced in developing arterial roads in remote and sparsely settled Australia. What of the developments in the United States, the world's most intensely motorised nation?

Very high density of traffic is being coped with by the creation there of the "perfect" highway system, superimposed on the tremendous road and highway network that has been built up over past years.

CURING CLOTH CONTROLS DRYING



After being laid, the concrete pavement is allowed to cure for about two weeks before any traffic uses it.

The U.S. program for the great 4,100-mile Interstate Defence Highway System has been succinctly described as the biggest building job in history and about 60 times as large an undertaking as the Panama Canal.

The program was set in motion in 1956 and so far construction has been mostly undertaken to replace inadequate sections of existing highways.

The mammoth project is designed to provide a new highway network consisting of "super freeways" coursing through every State and connecting practically every city in the U.S. of more than 50,000 population.

The United States already has well over three million miles of roads, of which more than two-thirds are surfaced. Since World War II the United States has developed several toll highways as alternatives to main routes carrying heavy traffic. These were privat financed.

Progressively, piece by piece, the U Government's New Highway System taking shape. Within the first th years nearly 10,000 miles of new c struction were completed, and there every reason to expect that the g undertaking will be completed by due date, 1971.

The highways are being built exacting standards. Depending on tra demands, a freeway will have two, f six or eight lanes, each lane 12ft width. A wide middle strip will sepa the dual roads making up the highw With a margin of safety the freew are designed for 55 m.p.h. aver travel.

These super roads will skirt m towns. This has two advantages:

(Continued on Page

This waterproof rubber insert is intended to eliminate the rhythmic b due to spaces between adjacent slabs. Expansion and contraction m produce a difference of three inches in extreme cases.

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PHILIPS NG1012

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  Plays all record speeds and sizes.
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"LAKE-WALKER" BUILDS BRIDGES

A newly-invented, electrically-operated machine that can float as well as 'walk' over water will soon be showing the nations how to speed up their bridge-building projects—and save money.

By John Drummond

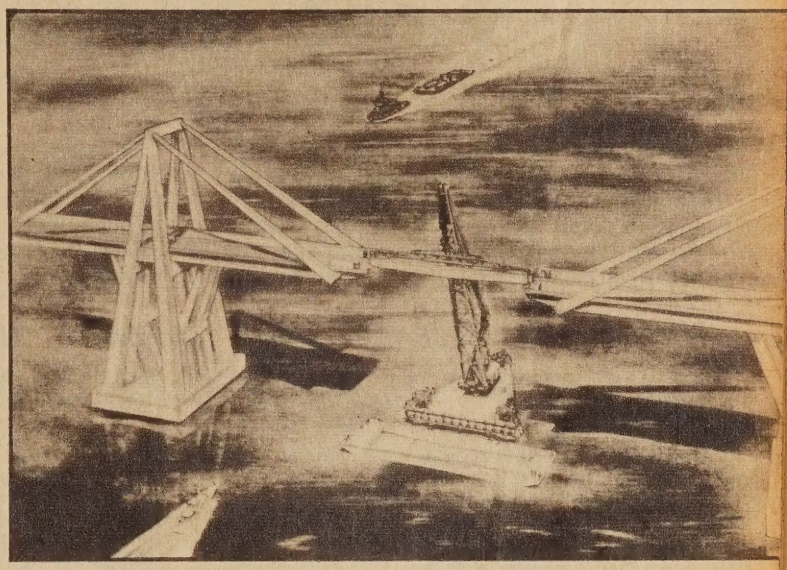
THE first major task of this bridge-building machine is the erection of a six-mile bridge, which is being constructed across the oil-rich Lake Maracaibo in Venezuela, a project scheduled for completion in the early 60s.

The designers of the "lake-walker," LeTourneau, famous for their massive machines, describe this particular machine as an "electric bridge builder." Essentially it comprises a 2,000-ton portable three-legged steel island, together with an enormously powerful marine crane towering high above its deck.

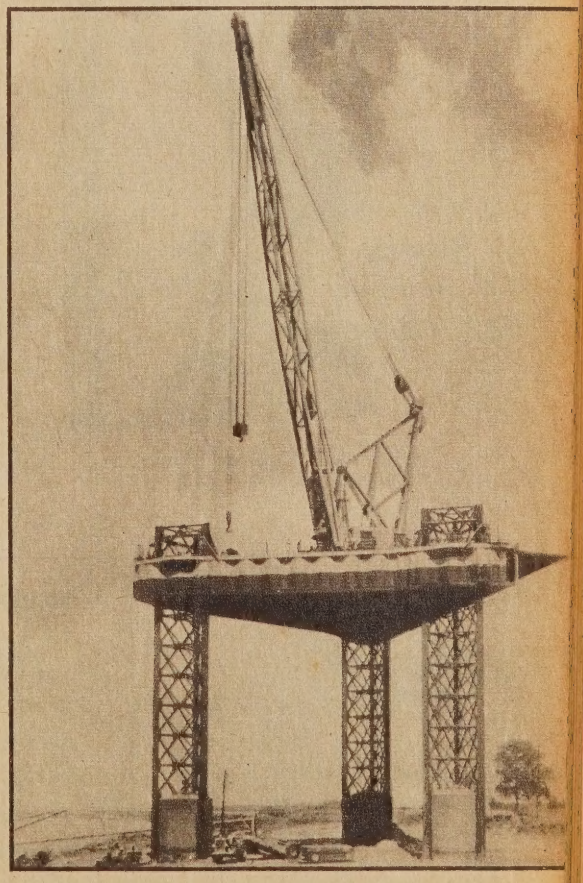
It will literally "lead" the bridge, step-by-step, across the six miles of brackish water, thereby creating a vital link between the oil city of Maracaibo and central and eastern Venezuela, as well as ultimately forming a further important link with the projected Pan-American Highway.

As the need for such a bridge became more urgent, the Venezuelan government put to its experts the problem of building one quickly. In turn, they consulted international bridge-building experts.

The result was the combining of the talents of four nations: a Swiss firm to design the bridge, two German and Venezuelan companies to build it, and the American LeTourneau to solve the problem of speeding up operations.



This engineering illustration drawing shows how the new mobile electric bridge builder will serve as key tool in constructing the six-mile concrete span across oil-rich Lake Maracaibo in Venezuela.



Men on the deck of the bridge builder and even the 20-yard earth-mover on the ground are dwarfed by the bulk of the bridge - building machine.

BUILT AND TESTED

So the massive Electric Bridge Builder came into existence, being constructed and tested at LeTourneau's marine facilities near Vicksburg in southern United States.

The "path" of the bridge-builder is usually strewn with obstacles and difficulties. The Maracaibo bridge is no exception. The lake itself, 100 miles long and 60 miles across its widest part, is a quaint mixture of oil derricks and Indian fishing villages, widely scattered.

It was these fishing villages, built over the water on piles, which originally gave Venezuela its name ("Little Venice").

When oil-bearing strata was discovered in the lake-bed in 1914, the palm-dotted, hot, swampy mosquito-infested lake-shores were quickly transformed, as oil derricks, pipe lines and other installations sprang up in and around the lake.

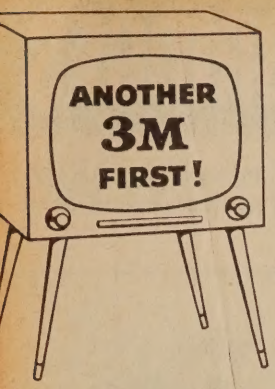
Lake Maracaibo lies on the extreme north-west of Venezuela, and is shaped like an oriental water-vessel, with the "neck" facing north and forming a channel-like link with the Gulf of Venezuela. The "oil" city of Maracaibo principal city port and second city in importance in the country, lies on the west bank of this "neck."

When we recall that Venezuela is the world's third largest oil-producer, and that Lake Maracaibo produces seven-tenths of this, we can perceive how great and urgent is the need of this bridge, to link together vitally strategic regions.

A major problem in building a bridge of this size, is the actual drilling and setting of the piles which support the structure, a task which normally can be accomplished only by using floating barges.

It can be seen that "stability" which in such cases is seldom more than a wish, and of course, work schedules, are

(Continued Page 51)



TRADE MARK

SCOTCH

BRAND

VIDEO RECORDING TAPE

ere's a milestone in television! 3M Research has t not only the sound, but the picture on magnetic pe. Right at this minute, teams of skilled research gineers are at work in 3M's Research Centre, llowing a vigorous and expanding programme of search. Already their efforts have produced a vast array of 3M products, produced in 23 plants throughout the world, proudly marketed under the trademarks "Scotch" and "3M." Their successful development of "Scotch" Video Recording Tape proves again 3M's belief that Research is the key to tomorrow.

THIS SAME RESEARCH HAS ALREADY GIVEN THE WORLD

"SCOTCH" MAGNETIC RECORDING TAPES

cotch" Brand EXTRA PLAY Magnetic Recording Tape 0 enables 50 per cent more tape to be wound on to any ool. For example, 1,800 feet can be wound on a stand- d 7-inch plastic spool. The magnetic coating is new, th a high standard of uniformity, excellent sensitivity d output for a given distortion. The tape's tough lyester base has outstanding mechanical properties over wide temperature range.

"Scotch" Brand Magnetic Recording Tape 111A meets the stringent demands of the most critical users—the chief radio stations of the world. Its features make it outstanding for any sound recording task. Widest frequency reponse and maximum saturation level, together with minimum distortion keep the "sparkle" in music and natural tone in voices. Only "Scotch" Brand Magnetic Recording Tape enables your sound equipment to operate at its best.

otch" Brand Extra Play Tape on Polyester lylar") base. Available on reels from 3¼in meter to 10½in diameter.

"Scotch" Brand Magnetic Recording Tape, wound on 7-inch spools to fit all recorders. Ask for Tape No. 111A. "Scotch" Brand No. 111V—P.V.C. Base. For the user who prefers a P.V.C. Tape. This tape construction, of course, incorporates all the magnetic advantages of a "Scotch" Brand Tape. Available on reels from 3¼in diameter to 10½in diameter.

PRODUCTS OF 3M COMPANY RESEARCH

Manufactured by
MINNESOTA MINING AND MANUFACTURING (AUSTRALIA) PTY. LIMITED
ntworth Avenue, Sydney. 2-0930 (30 lines)

POST THIS TODAY!

To: Sales Manager, Electrical Products Division,
Minnesota Mining and Manufacturing (Australia) Pty. Limited,
2 Wentworth Avenue, Sydney.

Please let me have further details of "Scotch" Magnetic Recording Tapes.

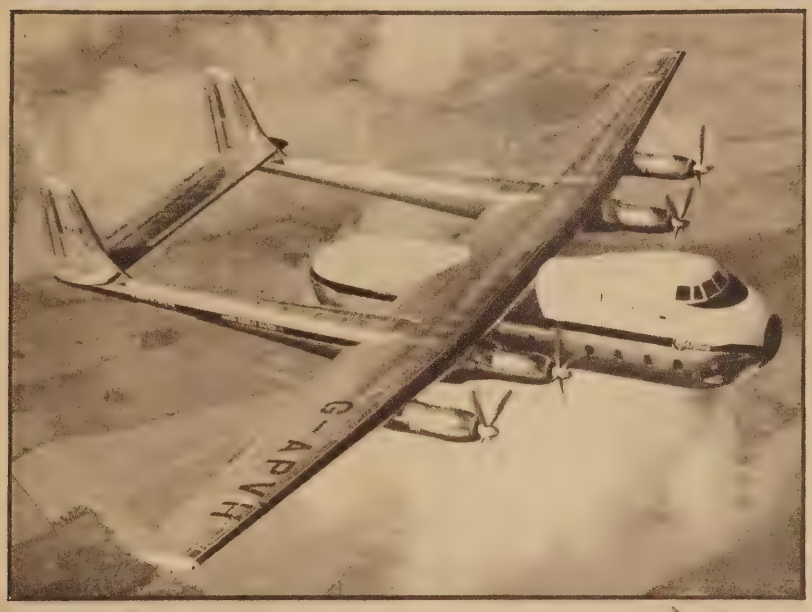
NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

AIR FREIGHT IS BIG BUSINESS



Typical of the modern freight plane is the Armstrong Whitworth Argosy 650 shown above. It can carry 80 passengers or over 13 tons of freight at a cruising speed of 300 m.p.h.

Freight carrying is no longer a sideline in air transport, to be used only for special items where cost is no object. British airlines are now carrying enormous quantities of ordinary goods every year, and in ever increasing volume. Economically, freight may soon be more important than passenger transport.

WORLD air business was good business in 1959, and the boom promises to go on through the sixties. The slashing of fares, already begun, will continue until the airliners are not merely luxury carriages for the tycoon and the gilded film star, but everyman's magic carpet.

But—a more startling change—the merchantmen of the air will become much more like trucks and trains and ships, bringing a thousand and one kinds of goods for us to eat or to wear or to brighten our lives generally. By 1970, the experts say, the world's airlines will be carrying more cargo than passengers.

Altogether Britisht airlines carried nearly a fifth more traffic in the year, and they plan a similar expansion this year, partly because of the boom in air cargo. The world's airlines have quadrupled this trade in ten years, and they have still only touched the fringe of it. All the most expert operators agree on that.

NEW BUSINESS

Many of the overseas Dominions are used to hearing of odd air freights in their remoter parts—things like heavy mining plant or drilling equipment, for instance—but the operators are now out to win new business in carrying ordinary everyday goods, lots of things which up to now have gone by land or sea routes.

Nevertheless, the kinds of consignments are bewildering in their variety. Five baby elephants flown from Holland to England were the highlight of Channel Air Bridge's year, a year in which the company's general freight was up 36 per cent., apart from a similar jump in the number of tourist cars it ferried over the Channel and the North Sea.

One of the practical demonstrations of economics it gave was the loading of vans at the factory in England and the delivery of the goods from the same van on the Continent without any intermediate handling.

Tropical fish by the thousand come up on BOAC services, mostly from Singapore. The new Qantas freight service from Australia brought in a rhinoceros which BEA flew on to Copenhagen. Silver City flew cattle and racehorses to the Continent and brought in French cars for final assembly at Kew. Transair flew Messerschmit and Heinkel cars, juke boxes and typewriters from Germany. Hunting's Africargo service flew eight frogs from Nairobi to Johannesburg for the annual Frog Olympic.

So much for some of the oddities. Now the operators are out to show traders that this is the natural way for their merchandise, not only the quickest but the safest and most economical way. They also point out that the speed of today's planes cuts down the need for holding large stocks at scattered shops or depots, since you can fly replenishments almost anywhere in the world in little more than 48 hours.

PRECIOUS CARGOES

Valuable gems and gold bullion have been going by air for years—the saving in insurance alone makes it worthwhile — and newspapers are another established air freight. But all high-value goods are potential cargo.

Pineapples come in from Africa, mangosteens from Malaya, persimmons, monstera deliciosa and other lush fruit from the tropics. Oysters fly. So do exotic orchids and out-of-season flowers, haute couture dresses and all sorts of quality clothing, delicate instruments, television transmitters, tube lighting installations and other fragile freights.

Already a network of all-freight services radiates from Britain over the world. Also it will not be long before what is in the cargo hold of an airliner is everywhere as important, economically, as the passengers.

The big operators are ordering freight planes to meet the boom, and the plane makers are producing them. The VC10 freighter has an enormous freight hold—as a passenger airliner or can carry a big payload in freight alone. The 40-ton Armstrong Whitworth Argosy, already sold to America, is on order as a tactical freighter by the Air Ministry, which will also take the 90-ton Short Hartland Britannic as a strategic freighter.

The Argosy 650 modified for combined passenger and freight service. It can carry 30 passengers and 6 cars or equivalent in other freight

BIG PLANS FOR SMALL TURBINES

A large American aircraft manufacturer believes that gas turbine engines will eventually power radically different earth-moving-bulldozing tractor combinations; fire engine pumpers the size of an ordinary ambulance; a highway freight tractor; and an air cushion vehicle—one of those amazing automobile-like machines that ride on a column of blown-down air.

By Allen Hobbs

THE company is the Boeing Airplane Company, which is currently engaged on a vast gas turbine development program.

U.S.-developed gas turbines may take the air in the spring of 1960 in both helicopter and a turboprop executive plane. Both planes will probably be production models of big American aircraft manufacturers.

The light, powerful and compact gas turbine engines will be installed in the aircraft for tests.

IMPROVED MODELS

The tests are designed to gather information that will lead to improved aircraft-turbine production models.

These newest power plants—designated the 520 series—in the Boeing Airplane Company's line of small gas turbines, have been under test for some time at the company's Industrial Products Division in Seattle.

Certification tests are expected to begin in the latter part of 1960. This will pave the way for the engine's use in U.S. commercial aviation.

Coupled with current production of the 502 series 240 horsepower turbines, the more powerful 520 series engines are geared to continue the often-discussed small-turbine revolution in power.

The engines, which have been running for more than a year, are a 325lb helicopter turbine, and a similar engine designed for executive aircraft.

A separate engine, designed for marine and surface applications, is also under test.

Boeing engineers conceived the 520 series early in 1953 and work began on design.

Performance at 500 horsepower with a specific fuel consumption of .65lb per brake-horsepower hour is being achieved in test cells.

To ensure reliability, ruggedness and low-cost production, designers emphasised the simplicity which had gone into the 502 series turbines.

NEW DEVELOPMENTS

Highly sophisticated but simple single stage elements such as the centrifugal compressor, compressor-drive turbine and power-output turbine were developed for the more powerful engine.

In 1955, Boeing received a U.S. Navy Bureau of Ships development contract for a new marine turbine. In 1956, the company was awarded another contract by the Navy Bureau of Aeronautics for development of a 400-horsepower turbine for trainer helicopters.

A new engine was developed for this contract and the two distinct product lines emerged.

In the development of the new engines, production problems were analysed and new techniques were perfected.

REDUCING COSTS

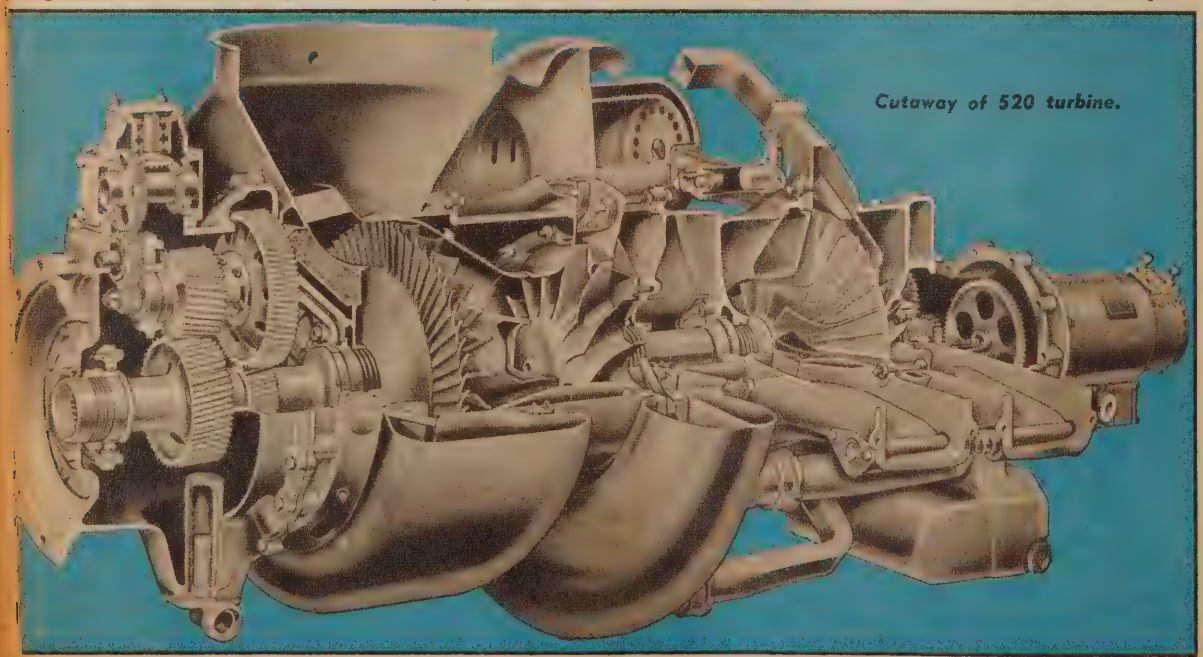
Manufacturing techniques have received as much effort as the engineering development of the Boeing turbines.

This effort has steadily reduced the company's turbine prices in the face of rising labour and material costs. Boeing is aiming at production quantities of the new 520 turbines in early 1961 that will bring the dollar-per-horsepower price on a competitive basis with 400-horsepower reciprocating engines for aircraft.

A 400-horsepowed conventional engine costs approximately 20 dollars per horsepower.

Use of 520 series turbines is expected to be stimulated by the engine's durability, reliability, high performance, compactness, light weight and low maintenance cost.

These characteristics have been prov-



Cutaway of 520 turbine.

ed by the performance of the earlier 502 series engines.

In its intended flight environment at high altitudes, the 520 turbine is superior to piston engines.

American engineers look to the inevitable spread of the turbine revolution to small commercial aircraft.

They feel that manufacturers, owners and operators of business aircraft cannot pass up the turbine advantages of increased speed and payload, low-cost high-altitude operation, and over-the-weather operation with its inherent safety factor.

Concurrent with the testing of the new 520 engine series, work is under way on a new engine in the familiar 502 series now in production.

The new 502 engine is expected to

have a continuous power rating of 270 horsepower.

With normal power growth of the 520 series, the Industrial Products Division expects to offer aircraft turbines in the power bracket from 200 to 600-plus by 1962.

The history of small gas turbine applications is filled with Boeing firsts.

These applications include the world's first turbine and twin-turbine helicopters, first turbine highway freight truck, first turbine locomotive, first commercial turbine boat, first turbine earthmoving tractor, a turbine racing car, turbine minesweeping launches now in U.S. Navy fleet service, turbine landing craft, turbine-driven electric generators, turbine-driven pumps and turboprop radio-controlled drone target and reconnaissance aircraft.

Boeing specialists are currently aiming 520 series applications at the areas which are the most advantageous province of small gas turbines.

But with the added advantages of a simple, easily maintained, lightweight engine giving unusual freedom to industrial designers, early use of small gas turbines in other applications is expected.

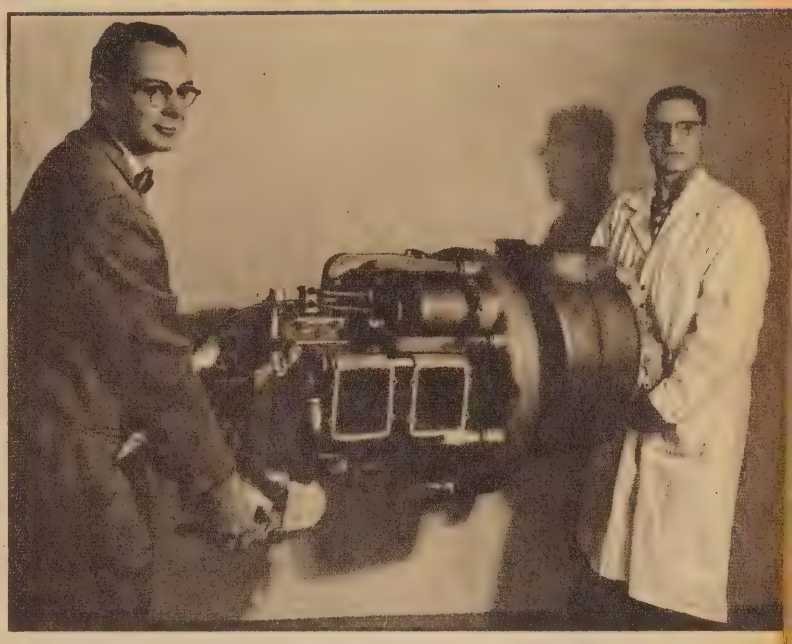
OTHER JET NEWS

ANOTHER development in the jet aviation field is the announcement by General Electric of their purchase of a French Caravelle airliner. Their intention, in conjunction with the makers (Sud Aviation of France) is to produce the Caravelle Mark VII jet.

This will be achieved by fitting it with General Electric CJ-805-23 aft fan-engines, after which the plane will be given extensive flight tests preparatory to government certification.

It is expected that the new engines will result in improved performance for this already popular aircraft, the higher thrust and lower fuel consumption making possible longer flights, greater operating economy and the ability to use smaller airports.

500 HORSEPOWER IS NO EFFORT



Two Boeing scientists demonstrate the lightness of the 520 turbine.

SPACE TELESCOPE FOR WOOMERA

A "Flying Telescope" that will be mounted in the nose cone of the Skylark rocket to take pictures of the sky and measure the intensity of ultra-violet light, has been developed by scientists working at London's University College.

"IN addition," said the physicist, Dr R. L. F. Boyd, leader of the space research group at the college, "we hope to find out more of the nature of the stars and the atmosphere, and perhaps even discover new astronomical objects radiating ultra-violet light at present invisible to us."

Work has been in progress on the flying telescope for nine months by a five-man team led by Dr Boyd. It will be flown in the Skylark at the Woomera rocket range in South Australia shortly. Skylark is purely a research rocket, originally developed and built for carrying instruments into the upper atmosphere during the Geophysical Year.

It is not a telescope in the conventional sense, but consists of six amplifiers, each set into a cast metal framework at different angles to the vertical, so as to look at a low angle of degree at the sky and measure the intensity of ultra-violet light. One of the six is fitted behind a cassegrain telescope (a telescope constructed of cylindrical mirrors).

A combination of readings from all the six photo-amplifiers, says Dr Boyd, builds up a composite picture of the sky and makes it possible to distinguish violet light from the stars from other sources of light, known as gaseous ne lae, which are vast clouds of inter-ste gas billions of miles wide.

The photo-multipliers, each fitted v a pure quartz window and a transpa cold cathode, are of special design, veloped and manufactured by E. Electronics, of Middlesex.

Six photo-multipliers work by b ing up a television-type picture of sky. This is then transmitted via a ra telemeter back to the earth. Scan of the picture is achieved from "yawing" rotary action of the rocke self.

In order to establish with accuracy direction in which each photo-multi is looking at any instant, a "moon d tor" has been incorporated in the This intercepts the light rays from moon and so allows a bearing t fixed from the moon's position.

The bearing of the earth's mag field is also fixed—by yet another d the magnetometer. Lastly, bearing earth's horizon are obtained from photo-multipliers themselves. The of these results will give precision t position to within one degree.

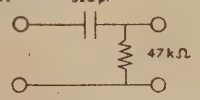
The Skylark rocket will reach a h of up to 100 miles above the surfa the earth before the pictures are t

acos

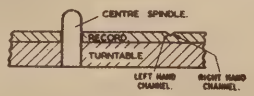
Crystal stereophonic cartridge

The "ACOStereo" 73 series is a universal cartridge designed to play stereophonic and microphonic discs, including 78 r.p.m. coarse-groove records. Three brackets are available. The "a" bracket fits the majority of arms, the "b" bracket fits Garrard RC.110 and RC.120 changers, and the "c" bracket is intended for American arms of the VM type.

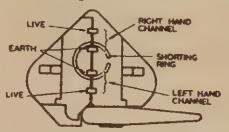
The output from the "ACOStereo" 73 is flat when fed into a 2 Megohm impedance. If record compensation is available in the amplifier it is advised that the output is converted to constant velocity characteristics by feeding through this circuit:—



The left-hand channel is defined as the channel reproduced by the left-hand speaker when viewed by the audience and is recorded on the left-hand groove wall when the record is viewed as:—

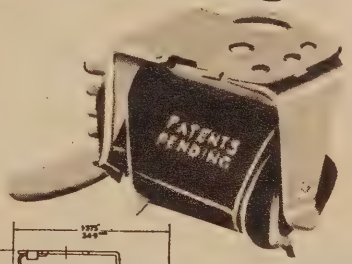


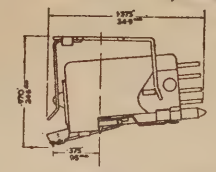
The "ACOStereo" cartridge connections as seen from the rear:—

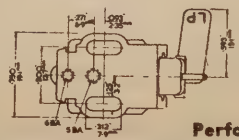


The shorting ring should be removed for use with amplifiers requiring separate leads.

"How Stereo Works" gladly posted on request.

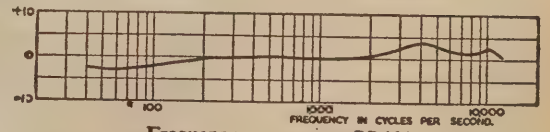




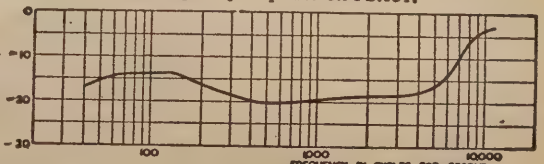


73-2A AND 73-5A . . .
Are the same physically but differ electrically.
All 73 series cartridges are available with two sapphire, and sapphire and diamond styli. Price: 73 series—cartridge incl. two-sapphire styli—£5/15/-; with sapphire and diamond styli—£11/18/6. Available ex stock.

Performance	GP73-2	GP73-5
Output at 1 Kc/s	225mV/cm/sec. R.M.S.	665mV/cm/sec. R.M.S.
Frequency Response:	Flat 40 c/s-12 Kc/s	Flat 40 c/s-6 Kc/s (Approx. 10dB down at 10 Kc/2)
Separation:	15dB at 1 Kc/s	10dB at 1 Kc/s
Stylus tip radii:	.0007" Stereo L.P. .0025" Standard	.0007" Stereo L.P. .0025" Standard
Recommended Load:	2 Megohms	2 Megohms
Compliance:	2.5 x 10^{-6} cm/dyne	1 x 10^{-6} cm/dyne
Recommended Tracking Weight:	4/6 Grammes	6/8 Grammes



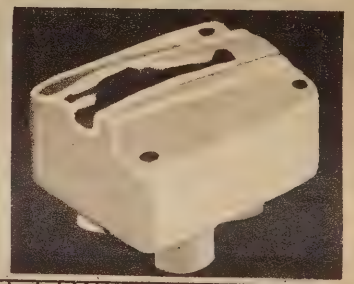
Frequency response on PS.131.

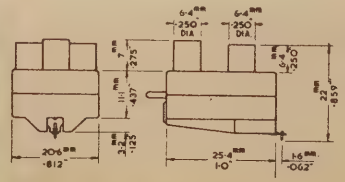


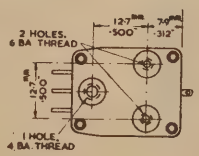
Separation between Channels on PS.131.

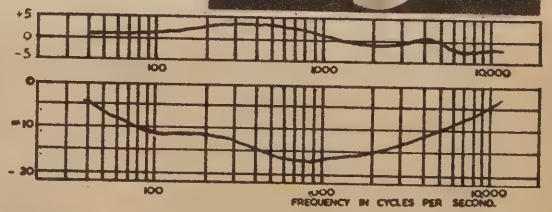
Performance: GP71-3

Output ..... 200 m.v. @ 1.5 cm/sec. Frequency Response ..... 40-12,000 c/s.
Separation between channels at 1 Kc/s ..... better than 15dB.
Radius of Stylus Tip ..... 12.5 microns min.: (0.00048").
..... 15.0 microns max.: (0.00058").
Recommended Load ..... 2 Megohms. Compliance = 1.5 ucm/dyne.
Stiffness = 0.067 x 10^{-6} dynes/mm.
The cartridge will track at a minimum of 2 Grammes, dependent upon the lateral freedom of the Tone Arm. Pressures in excess of 8 Grammes are not recommended due to excessive record wear.
71-3—for stereophonic and L.P. discs (non-turnover type).
Price £4/9/6 —with sapphire stylus.
Price £10/17/6—with diamond stylus.









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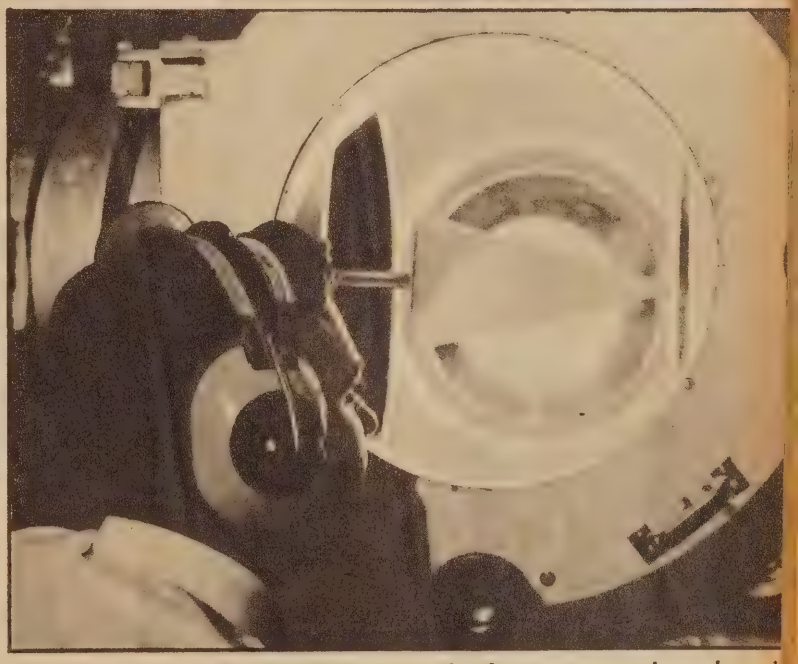
Around The World In Eighty Minutes

Jules Verne got the jump on science nearly a century ago with a tale of a long-range submarine, but even Verne never dreamed of such a machine as Dyna-Soar, a space glider which will travel at speeds approaching 18,000 miles an hour.

☆

The Dyna-Soar program involves additional research with metals at temperatures above 2000 degrees F.



Another facet of the Dyna-Soar program involves concentrated aerodynamic research in high-speed wind tunnels.

By William Jury

SPEED isn't Dyna-Soar's only attribute. Designed to circle the globe as a satellite does, Dyna-Soar will combine the controlled and accurate flight of a conventional aeroplane with the velocity of a ballistic missile. Launched from Cape Canaveral, Florida, for example, Dyna-Soar could circle the earth and come to a controlled landing at an air base anywhere in the country.

The U.S. Air Force has explained that Dyna-Soar will accomplish boost-glide flight by using both centrifugal force and aerodynamic lift. This concept is known as dynamic soaring, which explains the contraction, "Dyna-Soar."

The vehicle portion of Dyna-Soar will be a manned space glider. Boosted out of the earth's atmosphere into the vacuum conditions of space, the glider would encounter no atmospheric resistance and easily could circle the earth.

The military advantages of such a vehicle "are tremendous," Lt.-Gen. Bernard A. Schriever, head of the U.S. Air Force Air Research and Development Command, recently pointed out. Dyna-Soar will permit the introduction of human discretion.

ORBIT MANY TIMES

General Schriever said that later versions of the space glider can be made to orbit the earth many times and re-enter the atmosphere for a specific mission.

"Such a vehicle could be used as a satellite interceptor to inspect, board, disable and possibly destroy hostile satellites," the general added.

Did distinguished military leaders have Dyna-Soar in mind years ago when they predicted the importance of aero-space and pure-space flight activity?

"Predictions made by General Billy Mitchell and other military strategists were based upon fundamental principles," believes George H. Stoner, Dyna-Soar program manager at Boeing.

"A comparatively small number of reconnaissance vehicles deployed from close-in orbital altitudes can maintain essentially continuous surveillance of the earth's surface. From far-out orbital positions, nearly half the earth's surface can be seen from one vehicle, though with reduced ability to observe details."

Stoner also pointed out that the use of space opens up new freedom in communication.

He cited indefinite duration of flight as another fundamental principle. The flight time of aircraft today is eclipsed many times over by the potential flight time of orbiting objects. Ballistic missiles have much shorter flight times even than aeroplanes.

Where does Dyna-Soar fit into America's space program? The Mercury Project, which already is under way, would put man into orbit, but would bring him back from the satellite in a capsule that will return to earth by parachute. The X-15 rocket plane is being counted on to send a man into the border area of space and the earth's thin air and bring him back.

The man in the Mercury capsule, it has been noted, is "just along for the ride." The X-15 will be flown by man to the fringes of space.

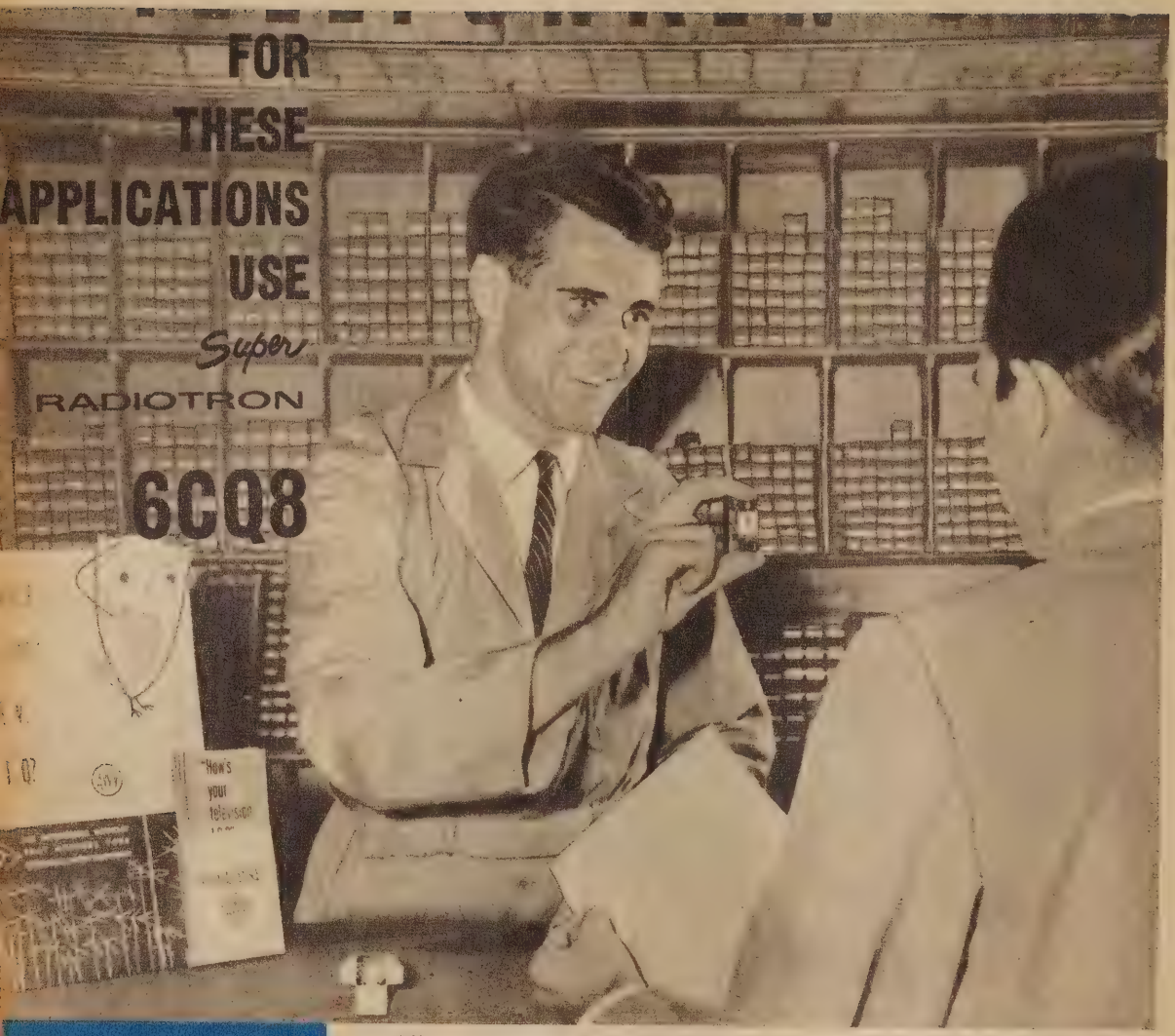
Dyna-Soar will accomplish both: it will take a man over the threshold and will provide him the means of getting home again by his own hand.

The Boeing Airplane Company wil responsible for the manufacture of vehicle portion of the system through a new management relation with the Wright Air Development D sion, will be responsible for integra of vehicle sub-systems, integration vehicle and booster, and assembly test.

The Martin Company, which peted with the Boeing Airplane C pany for the Dyna-Soar contract, manufacture the booster portion of system. The Air Research and Dev ment Command, Wright Air Dev mental Division, will act as sys manager.

The U.S. Air Force Ballistic M Division will be the principal agency the adaptation of boosters for the D Soar system.

First step in the development pro will be design and test of a glider w will bring a man back to a normal ing from hypersonic flight speeds. manned gliders and, later, ma gliders, will be launched from Cape averal down the Atlantic missile to explore technical and military lems associated with flight at speed proaching orbital velocity



All valves in the **Super Radiotron** range, including the **Super Radiotron 6CQ8,** incorporate the results of a programme of continuous improvement. For example, the pentode unit features a newly designed suppressor grid which improves the knee of the plate characteristic, and the triode unit has a new box type plate which minimises inter-electrode leakage.

In addition, strict quality control includes 100% testing for inter-electrode leakage as well as for shorts, continuity, gas, emission, RF noise and AF noise. The end result is a valve of superior performance and quality.

Since its introduction the **Super Radiotron 6CQ8** has been widely used by both designers and engineers. Some of the many applications are listed below.

- VHF Oscillator-Mixer.
- Picture IF and Sync Output.
- Sound IF and Audio Amplifier.
- RF Amplifier.
- Pulse Amplifier and Discharge Tube (TV camera).
- Voltage Discriminator (oscilloscope circuits).
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AUTOMATIC CONTROL OF POWER

The Electricity Commission of New South Wales will place in service during 1960 a comprehensive computing and control installation to regulate power interchange between its own system and the systems of the Snowy Mountains Authority and the State Electricity Commission of Victoria.

IN addition, the equipment will automatically load and unload generating units in seven power stations with a total capacity of one million kilowatts, to achieve greatest overall economy of operation.

The equipment will be manufactured and installed by Leeds and Northrup, U.S.A., through their Australian representatives, Alfred Snashall Pty. Ltd.

The power interchange control section of the equipment is of a type widely used on the huge interconnected systems of the U.S.A., and similar equipment is being installed by the Victorian and Snowy Mountains authorities.

Satisfactory interconnected operation of the three systems requires:

(a) that each system should absorb load changes in its own area by changes in generation on its own plant (without requiring supplementary adjustment in the output of plant on neighbouring systems).

(b) that generating plant should not be prevented by supplementary controls from contributing governor response towards the restoration of interconnection frequency pending absorption of a load change by the system within whose area the change occurs.

Both of these requirements will be continuously and automatically met by the new installations.

INTERCONNECTION PROBLEMS

On an interconnection comprised of a number of systems, frequency alone is not an adequate guide to the success of individual member systems in matching generation to load; again, although the in or out flow of power is a guide as to whether surplus or deficiency of generation exists in the area, tie line load alone is not a satisfactory index.

To provide an accurate quantitative measurement it is necessary to combine the two. The new control equipment does this, and the method of operation is described as "tie line load control with frequency bias" or, more simply, "tie line bias control."

The N.S.W. equipment will continually measure departures of tie line load and frequency from scheduled values and combine the two to give a precise measure of the amount, if any, by which generation must be raised or lowered on the N.S.W. system to restore tie line load and frequency to scheduled values.

If the load change is outside the N.S.W. system, the control will recognise this. It will make no attempt to change the level of generation from N.S.W. plant but will allow it to contribute governor response towards maintaining frequency.

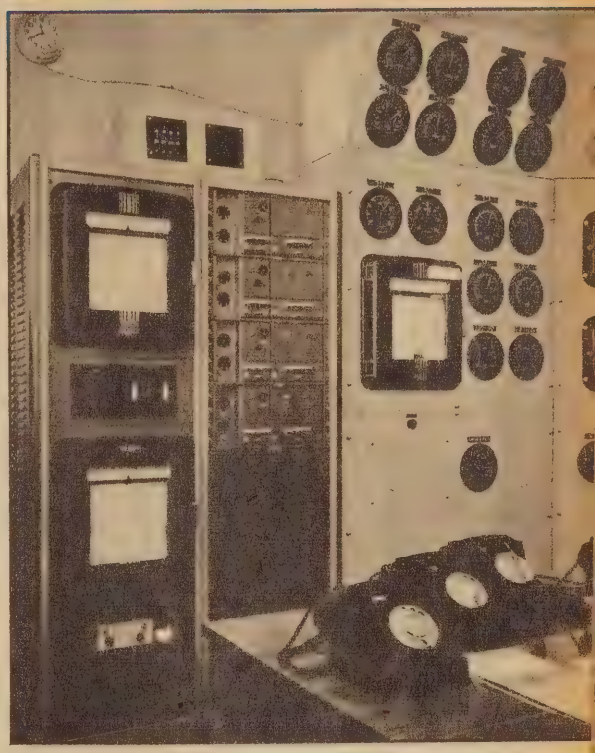
Where the load change is on the N.S.W. system, the amount of supplementary adjustment required will be used as the actuating signal in a master controller, which will transmit "raise" or "lower" pulses to the governor motors of generating units included in the control system.

The equipment will allow an operator to preset the value of power interchange which it is desired to maintain with an interconnected neighbour, and the control systems will then regulate the output of the plants to maintain interchange at this value within close limits.

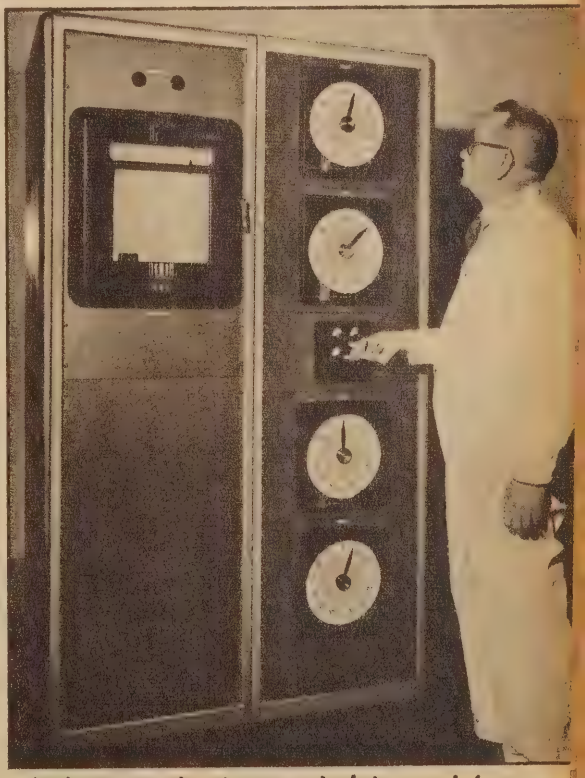
The New South Wales-Victorian-Snowy Mountains Authority interconnection differs in one important respect from other interconnections overseas, in that the Snowy Mountains Authority has no load other than the two State systems.

In view of this, the control equipment will include a completely novel additional feature whereby the N.S.W. system will be able to transfer a part of its regulating duty to the Snowy Mountains plant and, instead of a fixed scheduled value of interchange between the State system and Snowy, the scheduled value will be continually and automatically varied as required to meet system conditions.

(Continued on Page 27)



A section of the Electricity Commission's State control system control room, showing the temporary automatic master control equipment on the left.



A slave control unit currently being used for regulating the generators at the Pyrmont (Sydney) power station.

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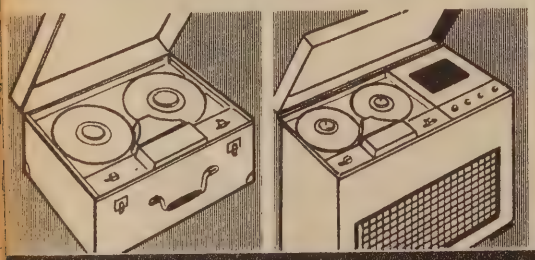

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TELEVISION SPEEDS THE MAILS

TV is now being used to speed the mails. A closed circuit system has been installed in the new Rotterdam Post Office to solve, economically and efficiently, a major problem in the mechanical handling of postal matter.

THE system opens up great possibilities for streamling, sorting and dispatch methods in congested mail rooms.

The Rotterdam installation consists of eight television cameras connected in closed circuit to eight television screens in a central control office.

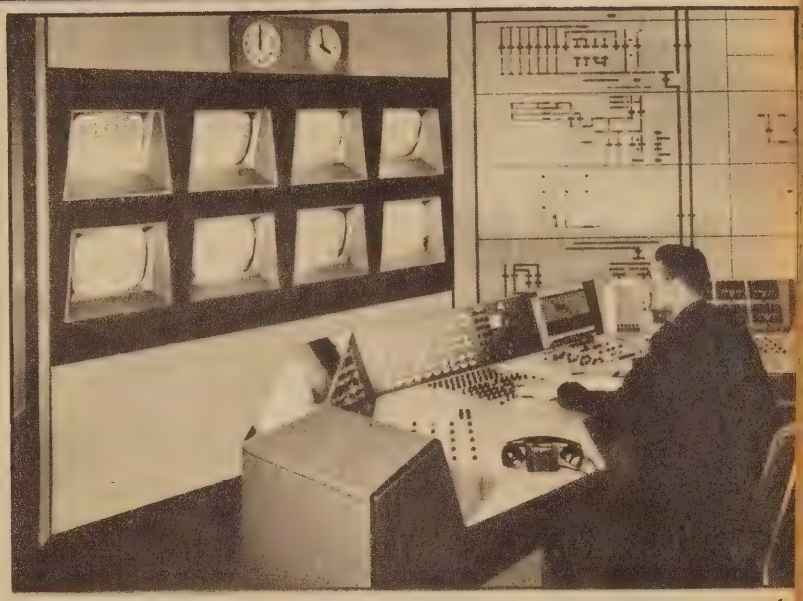
Each camera is trained on critical points in the conveyer belt channelling system along which incoming mail travels for sorting and despatch.

When a jam or congestion or any other irregularity occurs at any of these points, it is shown on the appropriate screen in the control office.

An observer at a specially designed desk is able to survey the situation and, by means of a series of push-button controls, to switch the mail from one conveyer to another or change the direction of a route to prevent or overcome the holdup.

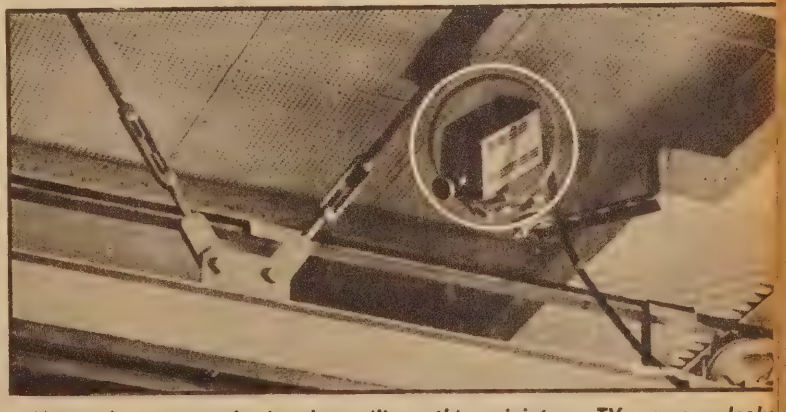
The system provides for the addition of further television cameras and screens for any future expansion of the Post Office facilities.

The Rotterdam installation was designed by Philips Industries Ltd., Eindhoven, in co-operation with the Netherlands Government's postal research laboratories.



From his desk, the operator watches on the TV receivers the progress of incoming mail through the channelling system. Merely by pressing a switch on the control unit, he can prevent or overcome any obstruction or delay.

A view of a conveyer belt as seen byone of the TV cameras.



Mounted permanently in the ceiling, this miniature TV camera looks directly down on the conveyer belt.

WATER BOOSTS OIL SUPPLY

FOURTEEN General Electric motors are helping the city of Long Beach, California in a unique business — the sale of salt water.

The motors drive big pumps to force salt water into deep oil wells under the city. The city will sell the pressurised salt water to oil companies for a cent a barrel, delivered.

Injecting salt water into the ground promises a double benefit: more oil should be recovered from the oil field, second largest in the United States, and land sinkage should be arrested.

More than 800 million barrels of oil have been taken from the rich, 20-square-mile field beneath the city in the last two decades. There has been some lowering of pressures in the underground sands, which have compacted, resulting in a settling or sinking of the land.

Salt water is being injected into the ground to restore underground pressures and counteract land sinkage. Feasibility of the water injection has been proved by elevation measurements of bench mark locations in the area, indicating that subsidence is being arrested.

On the 21st June the sun rises directly in line with the Hele Stone, as seen from the Altar Stone at Stonehenge.

Once upon a time—There was no time

When we talk about time we talk about something which most of us would find it very difficult to define. The best we could do would be to suggest something like "Time is what you haven't got, to listen, when someone sticks you up for a loan.' Or, yet again, "Time is what you do if you are caught robbing a bank."

by Calvin Walters

WE could add to this in endless fashion such as Time is what you can't get from work, to play golf in. Time what you have, to fool around with blonde secretary. Time is what you e, to have one for the road. Time what you haven't got, to dig the den. Time is what you waste watch- television. Time is what you get double for, for working for the boss public holidays. And so on.

None of these define time in the sense ch we are seeking. We cannot even that time is what your watch says or, uld I say, shows!

UNNY" YARN

his reminds me of the screamingly ny yarn where one little boy said to ther "does your watch tell the time," reupon the other little boy said "no, have to look at it!"

ime, as you will readily agree from above silly definitions is something ive. We think of time as being re- e to an event. In fact, time is really ccession of events such as birthdays, riages, deaths, holidays, anniversaries, k days, Melbourne Cups, harvesting, s, kings, queens, ancestors, ptero- yls and so on back to primitive man the birth of the universe.

How often have we heard it said, "my Jackie will be three years of age come next potato diggin'," or next pancake day, etc. Or "let me see now, Mrs Jones up the road said she was 38 when we first met her. That was the day Susie was born. Susie is now 21 which would make Mrs Jones 59 and she says she is only 48. I THOUGHT she was much older than she says. Looks it too doesn't she?"

Yes, time is only relative.

Time stretches also into the future with the same continual succession of events, without end as far as the whole universe is concerned.

Time has no beginning and no end. Looking up into the sky on a clear night we imagine we see all the stars at the same time period. We think we are looking at them at the same instant of time.

The fact is that we are looking into time. The light from different stars takes different periods of time to reach us. From some stars the light has taken thousands of years to reach us. From others it has taken millions of years. So that the light reaching us at any instant contains a story of events stretching far away into the past.

Einstein's theory of relativity maintains that time does not flow at a fixed rate and is different, when measured from various positions in space.

The speed with which a body is travelling affects the rate of flow of time to a marked degree so that time will advance much slower for a body travelling with it at a great rate of speed.

TIME SLOWS DOWN

The closer we travel to the speed of light, the slower time advances. Thus, if we could travel at nearly this speed, we would be able to travel out among distant stars and, on our return to earth, find that while our "rocket time" had advanced only a few months, maybe a million years had passed on earth.

Whether this be true is yet to be proved. Some scientists believe that the body would age at the same rate in any circumstances.

Einstein, in speaking about the absolute continuity of time, likened it to a departing guest who had overstayed his welcome. He said "time is like a departing guest, always going but never gone."

Primitive man had no very serious problems regarding time. To him one day was like any other. The sun rose in the morning and he went out with his club hunting either a wife or food. That's all he had to worry about. He didn't have to ring any Bundies or catch any trains. What a life!

The sun set in the evening and he slunk into his cave or hollow log with or without a wife or food, to sleep the sleep of the innocent until sunrise. What a life!

Despite his lack of a need for it, primitive man had a clock although he did not know it. He had the great clock of the universe which is the most accurate clock of all, in that the rotation of the earth and other planets round the sun is an absolutely regular procession which man, over the centuries has learned to read and record.

NIGHT AND DAY

The succession of day and night is due to the earth's rotation on its axis and the length of the day — upon which all our timekeeping is based—seems merely a matter of finding how long the earth takes to make one complete revolution.

But it is not as simple as that, because of the complexity of the movements of the earth through space.

Consider for a moment. In addition to revolving on its own axis, the earth travels through space, together with all the other stars and planets at 12 miles per second. It revolves with the moon around the centre of gravity of the two. It changes the direction of its own axis around a circular path once in 26,000

KEEPING TRACK OF THE TIME

years, resulting in continuous changes in latitude.

So it is that, although these movements of the earth and stars take place with incredible regularity, it is a precision job to be able to determine and measure them with the accuracy required for the recording of time.

Early man soon discovered that shadows cast by the sun changed position during daylight hours. He observed that this change was fairly regular and constructed sundials with marks to indicate the intervals between sunrise and sunset. They did not know anything about one o'clock, two o'clock, etc.

FOUR "TIDES"

Early Saxon people divided the day into four periods which they called "tides" from which we derive the terms "morningtide" and "eventide."

In those days agricultural pursuits required more attention than anything else and thus the seasons were the most important events to follow.

Early man found that a shadow cast by a stick in the ground or, as the sundial became developed, by the peg in the centre became longer in summer than in winter. Thus he was able to keep an indication of the seasons and marked the dial accordingly.

In England there is a remarkable ancient work shown at Stonehenge. It is fairly well publicised and schoolchildren are told about it. Stonehenge is believed to have been the site of religious rites carried out by the ancient Druids. Of this no one is certain.

There is, however, something which we are sure of but which it is not so well known. The stones of Stonehenge are so arranged that four of them indicate the seasons.

This is accomplished by using the variation in the rising and setting of the sun. Standing at what is known as the Altar stone and looking through the gaps between vertical stones, one can see a stone known as the Friars Heel. On the 21st of June at the summer solstice, the sun rises directly in line with this stone. The rising of the sun at the winter solstice and the setting at the summer solstice is recorded by two other stones in the outer circles.

KEEN OBSERVERS

These stones are believed to have been erected in about 1700 B.C. so that, even in those days, there were keen observers of nature.

As man's activities required more accurate recording of the period between sunset and sunrise, more attention was devoted to the making of various instruments. The sun dial still served during daylight, but something was needed to keep track of the hours at night.

Early Egyptians used a bowl of water with a small hole at the bottom. As the water dripped from the bowl it gradually filled a vessel beneath. By graduating this vessel with a scale of hours, a rough idea of the time of day was available.

The Greeks and Romans used an instrument called a clepsydra. This was more complicated and consisted of a vessel provided with a float.

Water dripped into this from another container. As the float rose it carried with it a rod fitted with a toothed rack. This in turn engaged a toothed wheel which, in revolving, turned a hand around a dial marked with the hours. Only the hours were marked on the dial, as minutes and seconds were not then thought about.

At the beginning of the sixteenth century a device for telling the time at night was developed. This was the "Nocturnal." It could only be used when the Pole Star and two of the pointers of the Great Bear constellation were visible.

In use, a dial was set to a scale showing the season of the year and the Pole Star sighted through a hole while the Nocturnal was held at arm's length. The arm was then adjusted until the lower edge was in line with the pointers, whereupon the time could then be read on a scale.

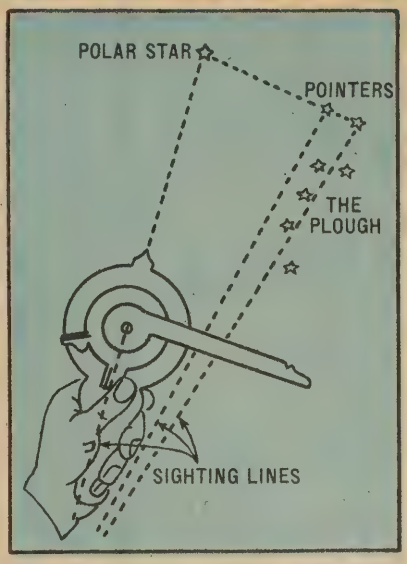
Another ingenious fellow invented a time signal where a lens concentrated the heat of the sun on the touch hole of a cannon at 12 o'clock. The gun then fired off with a roar and people for miles around were thereby warned that it was noon.

IDEAS FOLLOWED

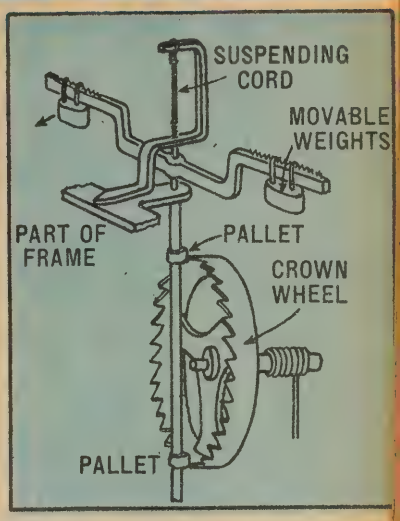
When the clepsydra was designed with its gear wheel and dial it set off a train of ideas which led to the invention by the father of modern clocks in France in the year 1600. This device made use of a drum around which was twisted a cord carrying a weight. As the weight fell, it turned the drum about its axle. The drum carried a hand which revolved round a dial showing the hours of the day.

As the drum revolved once for every 24 hours, the whole affair was of necessity very cumbersome and the length of the weight very limited.

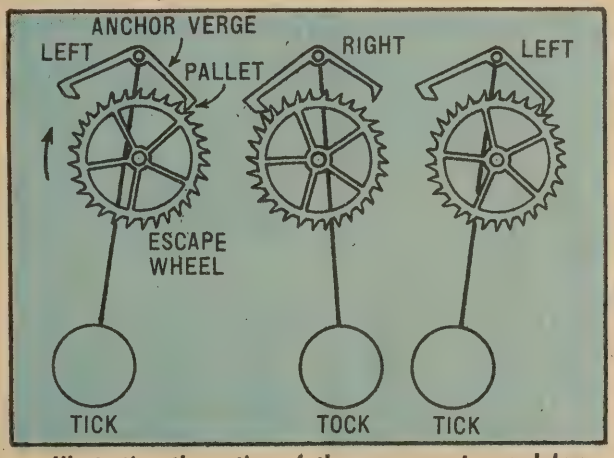
The clock had to be rewound every few hours, otherwise the weights would reach the floor.



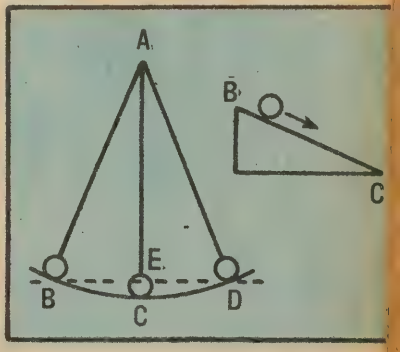
The so-called "Nocturnal" in use.



The Verge and Foliot mechanism.



Illustrating the action of the escapement—pendulum type of clock.



The pendulum can be likened in its swing to a ball rolling down inclines of varying lengths and varying degrees of steepness.

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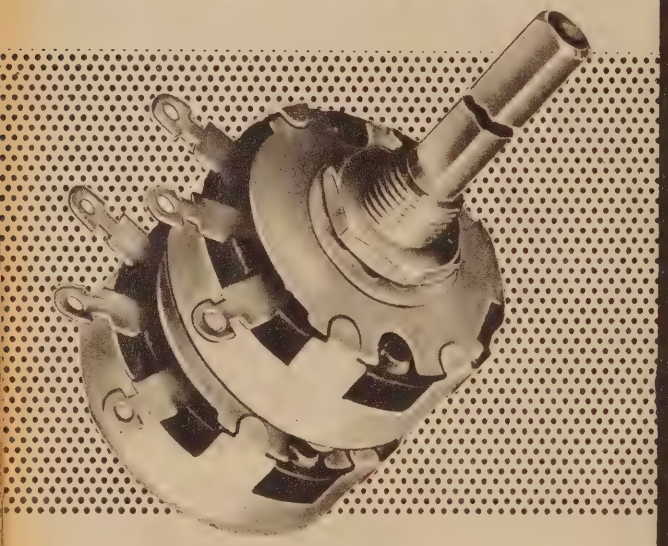

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This was overcome by the inclusion of some sort of gearing so that a small movement of the drum would give a large movement of the hand. This allowed the hand to turn 12 times for three revolutions of the drum and the clock would run for six days.

Then came the Verge and Foliot mechanism. It consisted of a vertical spindle provided with two teeth known as pallets attached to it. At right angles to the shaft was a horizontal bar containing a weight at each end held in notches for adjustment. A notched wheel, called a crown wheel, was revolved by the fall of a weight. In revolving, it caused the upright spindle to perform certain gyrations.

It also carried out certain functions. Firstly, the arrangement of the pallets permitted the toothed wheel to spin the vertical shaft first in one direction and then in the other. This carried the weighted cross arm with it, first in one direction and then in the other. As the pallets escaped from the crown wheel this to-and-fro movement continued until the string around the crown wheel unwound.

By a suitable connecting mechanism

Built in Switzerland in 1694 this water clock has to be filled regularly. Note chain mechanism to operate the hands.

this movement turned the hands of a clock round the dial. A similar type of system, greatly improved, is seen in the present one hundred day clocks. Springs are, of course, used to turn the crown wheel in the modern clock.

Of course, the use of weights to turn the mechanism of a clock is in use at the present day. We see it in ornamental cuckoo clocks and in grandfather clocks. The latter clocks make use of a pendulum and it is the latter of which we will speak at some length.

IMPORTANT STEP

The use of an escapement was a momentous stepping stone in the development of clocks, for it permitted the control of the gearing mechanism. It can be said that the first really important development in escapement mechanism was the use of the pendulum.

The pendulum has some very peculiar properties which were said to have been discovered by Galileo, who, while sitting in the cathedral at Pisa, focused his attention on a lamp suspended from the ceiling by long chains.

By using his pulse as a check, he noticed that the time of the swing of

VERY ANCIENT, VERY MODERN

A modern electronic watch testing machine. Its performance is plotted on a moving graph paper for various physical positions. The graph shows up any tendency to speed up or slow up or operate erratically.

the lamp remained the same, despite the fact that the swings became progressively shorter.

This property of a pendulum is called isochronism and, as every word should mean something, this word is taken from the Greek words "iso," meaning the same, and "chronos," meaning time.

Another fact which Galileo noted was that lamps on long chains took longer to swing to and fro than those on short chains and thus the length of swing was dependent on the length of the chain. History does not say whether Galileo gained any spiritual enlightenment from the cathedral service, but presumably he did not pay a great deal of attention to it.

HARD TO UNDERSTAND

The reason for this peculiar behaviour of a pendulum is not understood by most people. Neither is it easy to explain, without going into a lot of mathematics.

It is not easy at first to see why, if a pendulum bob is brought to an almost horizontal position and then let go, it will swing from one side to the other, and continue to do so, in almost the same time as if it was released only an inch or two on one side of its resting point at bottom dead centre. No matter what the length of arc for a given length of pendulum, the time of the swing is essentially the same.

The old saying that "everything that goes up must come down" is very apt when considering the forces acting on a pendulum.

Gravity is the force which acts on the bob of a pendulum and, when it is brought to a position beyond the vertical on either side, gravity pulls it down again.

One of Newton's laws of motion i forms us that once a body is set motion it will continue to move in t original direction after the force has be removed until stopped in some way. stores up the energy given to it. Th is called Kinetic Energy. This ener keeps it moving after the original for has been removed and until the ener has been expended in overcoming fr tion and so on.

If the bob of the pendulum was mere an unsuspended weight, it would f directly vertically from where it is let g

Being attached to a cord or rod st pended at the top, it is prevented fr falling vertically and describes an a downward to its lower point, gatheri energy sufficient to take it past this po and up along the arc the other side.

When it reaches the point where t force of gravity is greater than the forc pulling it out and up, it reverses dir tion and falls again, and so on, ur finally friction brings it to rest—fricti from its support at the top and fricti from collision with the air in its pa

VERTICAL DISTANCE

It will be seen from the diagram th the bob is really falling through a v tical distance EC, although it does through an arc of a circle.

One of the difficult things to expl is why a given pendulum takes ess tially the same time to describe its a irrespective of the length of that arc. has been worked out mathematica but most of the explanations I've r are harder to understand than the origi problem—if you get what I mean.

They proceed on the assumption t

(Continued on Page 7

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A complete stereo recording studio in one portable unit.

Tapes both stereo and monaural recordings—for your record library!

A full hi-fi stereo playback and recording unit: inbuilt speakers, hi-fi stereo amplifier. Plug in a pickup—it becomes a stereo hi-fi outfit!

Recorded stereo tapes, classic and jazz, shortly available.

ced at £330 (including 2 super hi-fi stereo crophones).

ghest trade-ins on your old Grundig model.

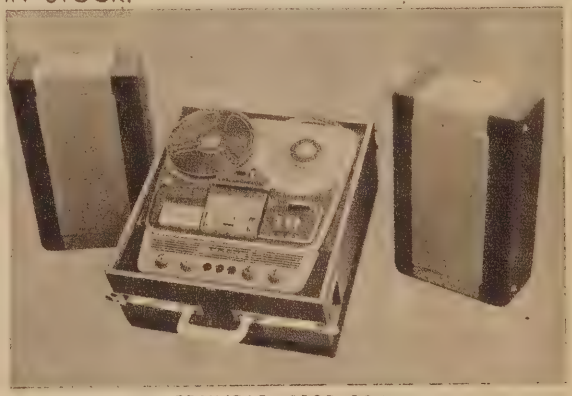
LEFUNKEN: This famous name is the llallmark" in Tape Recorders.

s model, just released, incorporates a new styling in tape rders. The reproduction is magnificent: 2 speeds, twin k. Complete, of course, with tape and supergrade moving microphone.

CIAL LOW PRICE 135 gns.

ING—yes, you can hire a latest model tape recorder for 25/- per day.

NOTE: WE ARE THE ONLY AUTHORISED GRUNDIG DEALER IN SYDNEY WITH SPECIALISED, ON-THE-SPOT REPAIR SERVICE MANNED BY GRUNDIG TRAINED ENGINEERS. A FULL RANGE OF GRUNDIG PARTS & ACCESSORIES IS ALWAYS IN STOCK.



GRUNDIG £139/10/-

TELEFUNKEN 135 gns.

GRUNDIG STEREO £330

SPECIAL BONUS COUPON OFFER

This coupon entitles the buyer of any tape recorder to a FREE reel of long-playing tape (1,800ft) worth £3/19/6.

AGNETIC SOUND INDUSTRIES

387 GEORGE STREET, SYDNEY.
(2 doors from Kodak) BX4440 BX4587

Technical Review

TRANSISTORISED AUDIO VOLUME COMPRESSOR UNIT

This transistorised audio compressor has unity gain with expansion of 3 db and a compression of 12 db. Gain adjustments are automatic.

TO maintain an even recording level during tape-recorded interview sessions, the tape recorder operator may have to make gain adjustments to compensate for variations in speech levels of different speakers and for level changes due to changes in distance between the microphone and the person being interviewed.

At most radio stations, two volume compressors are used between the studio and transmitter. The first operates as an average program control and the second operates as a peak limiting amplifier to maintain a constant peak percentage of modulation.

At some stations, inputs from tape recorders and remote lines have individual automatic gain devices. These are of little help if the signal from the remote line or tape recording is of insufficient level in relation to the line noise.

When interviews are being conducted and recorded by one man, the necessity of making gain adjustments sometimes breaks the reporter's chain of thought during the interview.

The transistorised audio compressor is automatic and requires no operating controls.

It has the added psychological effect of assuring the reporter of a good recording which allows him to concentrate on the event he is reporting without concern for precise microphone distances or gain control settings.

The audio compressor shown in Fig. 1 is a transistorised unity-gain amplifier having an expansion of 3 db and a compression of 12 db around an average level of approximately 45 db below 1 v at an impedance of 10,000 ohms.

The compressor is inserted after the microphone amplifier.

The incoming audio signal is amplified by Q1 and applied to the diode compressor through C1. The diode compressor is essentially an L-pad attenuator, with R1 forming one leg and diode D3 the other leg.

Diode D1 rectifies the audio signal and applies the resultant DC voltage through R2 to diode D3. The impedance of D3 varies almost logarithmically in inverse proportion to the DC voltage across it.

Diode D2 protects filter capacitor C from any reverse polarity switching transients that may be applied from the output.

The curves of Fig. 2 show that about 15 db attenuation is available. A portion of this loss is made up in the transistor amplifier, thus permitting installation of the unit as a unity-gain amplifier with an expansion of 3 db and compression of 12 db. Total consumption is approximately 0.6 ma.

The frequency response of the compressor for various input levels is shown in Fig. 3.

A tape recorder using this automatic gain compressor has been successfully used to report events from the quiet of an empty hall to the noisy cockpit of a small private plane. (From "Electronics," by E. C. Miller, Technical Director, Inland Broadcasting Co., Weiser, Idaho.)

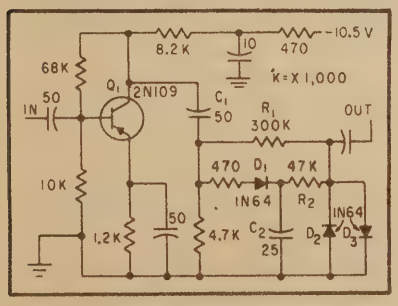


FIG. 1—Audio level compressor is basically a variable L-pad attenuator.

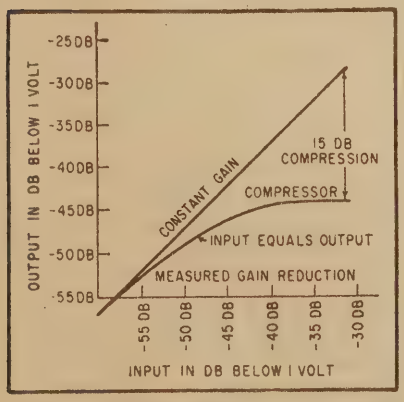


FIG. 2—Approximately 15-db compression is available from the device.

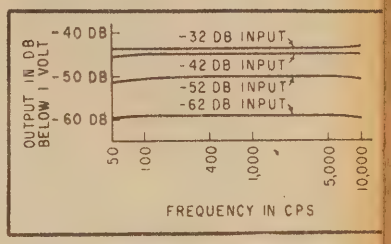


FIG. 3—Frequency response of compressor at various input levels.

LONDON TO BIRMINGHAM TV LINK

THE first long-distance trunk TV circuit in Britain to be built and maintained by private enterprise was formally handed over to Associated Television in London recently.

The circuit carries vision and sound from the Alpha Studios at Aston Road, Birmingham, to the A.T.V. London headquarters at Marble Arch. It will enable A.T.V.'s London management to monitor programs originating in Birmingham and to watch rehearsals, etc. It will enable advertisers in London to see programs radiated from Birmingham without having to travel there as at present.

The new microwave scheme, manufactured and installed by Pye Telecommunications Limited, has many entirely novel features. Operating on 7,000 megacycles, it makes use of passive reflectors, which eliminates the expensive waveguides normally required to carry the transmitter power to the aerials. The microwave link carries high quality TV sound in addition to the picture.

Radiotelephone circuits for engineering maintenance have been put on a separate 450 megacycle channel. One of its features has been very low cost.

The circuit, which is routed via automatic radio repeater stations at Meriden, Cold Ashby, Barkway and Highgate, is 135 miles long. The repeater stations are fully automatic and unattended.

JACOBY, MITCHELL back sales with service

A view of section of the laboratory on the top floor of our building at 469-475 Kent Street, Sydney, where our technicians exhaustively test all equipment before we offer it to the public.

This picture shows a batch of new "Serviscopes" from Telequipment Ltd., of London, being tested on arrival.

All new instruments are first given a "Soak" test — coupled to a time switch which cuts the power off and on at regular intervals.

If the instruments pass this test (which continues for 12 hours), they are given a complete functional test and then a detailed, mechanical inspection.

In the photograph above, the two trainees in the foreground are giving the oscilloscopes a mechanical inspection while the technician in the background applies a high frequency square wave to check the amplifier response synchronisation, etc.

Naturally, not all instruments pass a test as rigid as this.

Some are affected by the trip from England.

Some fail for other reasons.

But, if they do fail, they are carefully readjusted by our technicians and then tested again.

When we are satisfied with their performance — and not before—the instruments are offered for sale.

Since after sales service is essential for an organisation such as ours, we have staffed our laboratory with experts trained by our overseas principals in their factories.

Some have come from France, others from Germany.

One of our Australian staff members leaves soon for England for 12 months further training.

Knowledge and skill such as this is your surest guarantee of satisfaction when you deal with

JACOBY MITCHELL
EQUIPMENT FOR INDUSTRY AND RESEARCH

JACOBY, MITCHELL & Co. Pty. Ltd.

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(MA8411)

113 Bridge Road, RICHMOND, VIC. (JB5100)

135 Beaumont Street, HAMILTON, NEWCASTLE, N.S.W. (MA4744)

REVIEW—A TRANSISTOR PHASE-SHIFT OSCILLATOR

Described by F. T. Merkler in the magazine "Radio-Electronics," this simple 1-transistor phase-shift oscillator is claimed to put out stable sine waves suitable for use in bridge circuits, electronic music devices and so on.

FOR some reason, transistor phase-shift oscillators have not received the attention they deserve.

It is true that the transistor version seems more difficult to design than the vacuum-tube circuit, but this is not due to a defect in the transistor but to an attempt to apply vacuum-tube thinking to an entirely new type of device.

Perhaps you can physically replace a vacuum tube with an audio transistor (properly biased) in a standard three-mesh network and have it operate, if you make the supply voltage high enough and pick a transistor with a high beta.

This transistor circuit has definite advantages. When correctly designed, it produces a crisp sine wave, starts easily and continues oscillating until the battery drops to about 4 volts. Not to be overlooked is the low cost of the few small parts needed.

RELIABLE CIRCUIT

The unit described here is the result of painstaking effort to produce a quality circuit that would be reliable, easily started, stable under temperature change, and would allow for unavoidable transistor variations.

It oscillates at approximately 1,000 cycles with the components specified.

Eleven 2N109 transistors were tested for DC beta to be sure of a proper spread in characteristics. Each variation in the circuit was tested with each of the 11 transistors at five supply voltages from 13 to 4 volts DC.

The final circuit is a four-mesh network with voltage feedback from collector to base of the grounded emitter amplifier. The feedback circuit protects the transistor from thermal runaway.

One of the tests given the completed unit was a heat run, with a test setup that monitored transistor case temperature, collector current and frequency.

At the start of the run, case temperature was 28 degrees C, collector current was 4.4mA and frequency was 1,171 cycles per second. Supply voltage was held at 10 volts DC throughout the run.

HIGHER TEMPERATURES

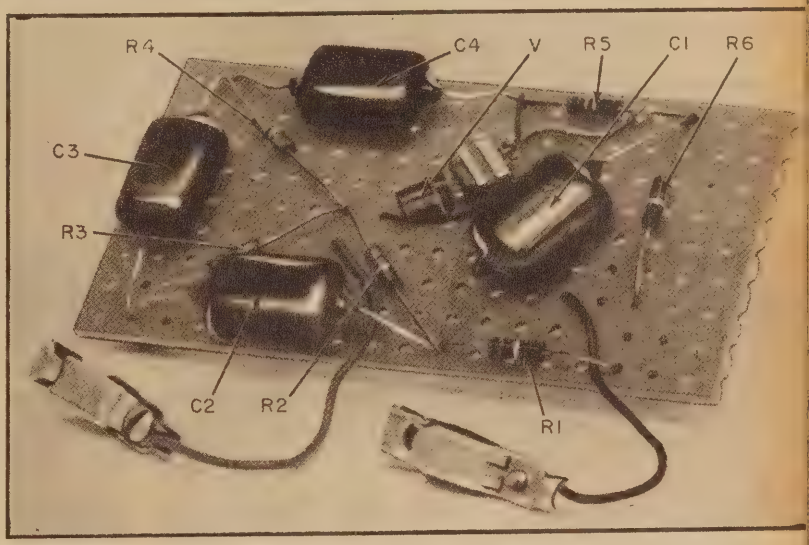
At a case temperature of 63 degrees C, collector current was 7.8mA and frequency of oscillation was 2,202 cycles per second. At a case temperature higher than 63 degrees C (149 degrees F), the circuit no longer oscillated, but the transistor was not damaged as its collector current levelled out at about 8.1mA.

The case temperature was taken up to 71 degrees C, which is the manufacturer's specified maximum, and the external heat removed.

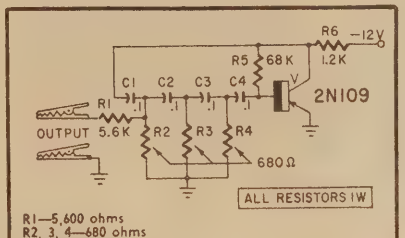
As the circuit cooled, current drain slowly decreased and the unit resumed oscillating at about 63 degrees C.

The phase-shift oscillator was kept operating at normal room temperature for about 24 hours with a Berkeley counter set to record the frequencies on a graph.

No failure occurred and the frequency settled down to 1,118 cycles per second, with a 3-cycle variation over the time period.



The whole works makes a compact and neat layout when parts are mounted on a perforated phenolic board.



R1—5,600 ohms
R2, 3, 4—680 ohms
R5—68,000 ohms
R6—1,200 ohms
All resistors ½-watt 10%
C1, 2, 3, 4—0.1μf, 15 volts or higher
V—2N109
alligator clips (2)
Phenolic chassis board
Miscellaneous hardware

Circuit of the 1-transistor oscillator.

Practical uses for this circuit are numerous. A small probe-type unit can be made up, with a male phono plug on the output end ready to test audio amplifiers.

Use the oscillator for musical instruments and toys; it has good stability and is economical to build. In these applications if you wish to vary the frequency, vary the capacitance in the network, not the resistance, to get new and different tones.

EXAMPLE

For example: make each capacitor (C1, C2, etc.) equal to .068pf and you will have a frequency of 2,100 cycles per second. In building this circuit, remember, good stability depends on high-grade components.

Use impregnated-paper capacitors and 1-watt composition resistors. I know 15 or so of these oscillators that have been built into receivers, test oscillators and impedance bridges. At no time was any difficulty experienced with this circuit. Use it with utmost confidence.

(Editor's note: The writer shows the output as being taken from the junction of C1 and C2. It would seem logical to take the output through the isolating resistor R1 and through a separate coupling capacitor directly from the collector of the transistor.)

AUTOMATIC CONTROL

(Continued from Page 17)

Pending the installation of the permanent equipment, the Commission has successfully tested pilot automatic equipment to regulate the 200,000 kW Pyrmont power station, and for the time being the output of that one station will be regulated to achieve control of interchange with the Snowy Mountains and Victorian systems.

With the extension of control to all seven stations, load dispatching will be placed on a fully automatic basis. Computation of the most economic loading arrangements will be made by a Desired Generation Computer which will direct to appropriate power stations the "raise" and "lower" pulses generated by the tie line bias controller.

The computer is of the electrical analog type, and will load generating plant for minimum incremental cost of power delivered to load centres. These computations will take account of unit incremental heat rates, fuel costs, power station performance factors, transmission losses, and other factors. The computer can readily be modified to take account of the temporary unserviceability of a unit, so that the characteristics of plant available can at all times be accurately simulated.

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE NEW RANGE OF MONAURAL AND STEREOPHONIC EQUIPMENT

Stereophan LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier wih tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

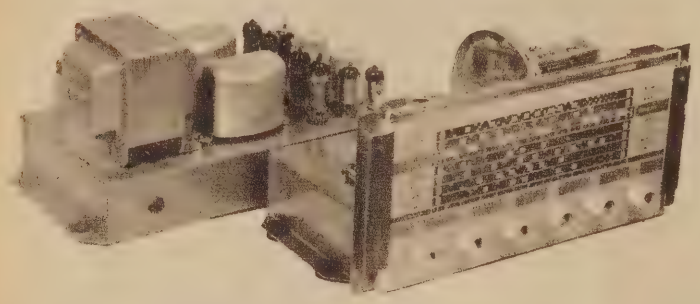
10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 3-3" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles.

£41/15/- F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive 'magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder. special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

NEW *Releases!*

IN HI-FI TAPE RECORDERS

THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with perspex dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

Model TR2 incorporates the new Collaro "Studio" Deck which features:—

- **High Fidelity. Frequency response 40 to 12,000 cycles at 7½in per second.**
- **Three 4-pole shielded motors.**
- **Three speeds, 1-7/8, 3¾ and 7½.**
- **Fast forward and rewind, 1200 ft in 65 seconds.**
- **Two track.**
- **Light piano key controls.**
- **PAUSE CONTROL**

This has the effect of stopping the transit of the tape past the "Record/Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.

- **TAPE MEASURE AND CALIBRATING DEVICE**

The three digit counter makes the location of any recorded passage the simplest of operations.

- **TRANSCRIPTION TECHNIQUE**

A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A NEW POPULAR PRICED RECORDER AT 49 gns. f.o.r.

MODEL TR3. For this recorder we have chosen the new English B.S.R. deck. This is a two track single speed unit (3¾in per second). Giving two hours' playing on a 5¾in long play tape or one hour on a standard 5in tape.

Automatic locking device prevents accidental erasure. Frequency response 60 to 8,000 cycles.

The five valve amplifier including "magic eye" level indicator has two inputs, for microphone, radio, or pick-up; and outputs for external amplifier or speaker, equalised to C.C.R. standards. Can be used as straight amplifier if required. Output 3 watts.

The recorder is fitted in attractive two-tone case with dual speakers and microphone.

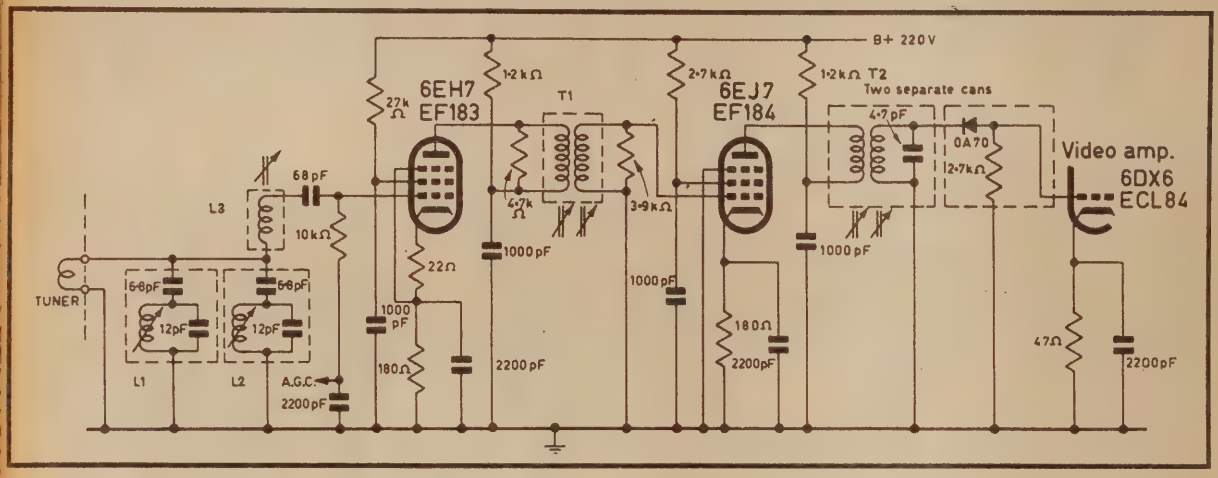
Overall dimensions 14in x 10in x 6½in. Weight 26lb.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

FRAME GRID VALVES FOR TELEVISION

A TWO STAGE VISION I.F. AMPLIFIER USING 6EH7 AND 6EJ7



A Mullard contribution to the manufacture of high performance electronic valves is the technique known as Frame Grid construction.

This principle, used in the 6ES8/ECC189, made possible a marked improvement in tuner performance — R.F. gain increase of 3 to 6dB and a noise figure improvement of 1 to 1.5dB over the performance hitherto possible.

In a similar way the new frame grid I.F. valves 6EH7/EF183 and 6EJ7/EF184 yield enhanced performance over conventional high slope pentodes because their mutual conductance is approximately double that of their predecessors, whilst thanks to the frame grid technique, input and output damping remains comparable.

As a result, a two stage vision I.F. amplifier may be constructed having a gain bandwidth product in no way inferior to a conventional three stage design. Indeed when such a six pole amplifier design having a 4.5 Mc/s bandwidth centred on 33.65 Mc/s is coupled to a tuner employing the 6ES8/ECC189 a sensitivity of 40μV at the 300 ohm antenna terminals for 1-V.D.C. at the video detector is readily achieved.

ABRIDGED OPERATING CHARACTERISTICS

	6EH7	6EJ7
Heater Ratings	6.3V, 300mA	6.3V, 300mA
Va	200V	200V
Vg2	90V	200V
Vg3	0V	0V
Vg1	—2V	—2.5V
Ia	12mA	10mA
Ig2	4.2mA	3.8mA
gm	†12.5mA/V	15mA/V
ra	500 Kohms	350 Kohms
μg1-g2	—	60
* rg1 (f=40 Mc/s)	40 Kohms	30 Kohms

* Input damping of the valve and typical ceramic socket with both cathode leads connected directly to earth is approximately 10 Kohms.

† For 100 to 1 reduction in gm Vg1 —19.5V.

Mullard

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Mullard

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ENGINEER, WRITER AND MUSICIAN

"John Moyle has a marked literary facility and, if he finds scope for his powers in that field, he may be relied upon to do his utmost to bring distinction to himself and his employer."

THESE prophetic words appear in John's school testimonial. How true they were!

All who knew him, and particularly those who worked with him, praised his facility and perception as a writer. Whether "selling" an idea or explaining a difficult technical point, his style was always clear and unambiguous.

He set a standard which may well become a tradition.

Born in Malvern, Victoria, on February 28, 1908, John Murray Moyle was educated at Scotch College, Melbourne. His record there as a student was impressive.

A member of the debating team, he won the school debating prize in his final year, 1926. He was editor of the "Scotch Collegian" and wrote the colcough Prize song—indicative of his early musical appreciation.

Principal of the college, Dr W. S. "Bill" Littlejohn, wrote: "The list of offices which he holds in the school shows that he is a lad of high ability and exceptional energy . . . He has earned the thanks of the school for his work . . ."

No wonder John always spoke so affectionately of his days at "Scotch."

On leaving school, John's first job was at 3DB, Melbourne, working in the commercial advertising department.

Then, for a while during the depression years, he edited a farming magazine, the "Gippsland and Northern." In this position his enthusiasm was greatest in the section devoted to reviewing new cars, which he drove and tested personally.

While so doing, John still found time to write short stories and poems—some of them published in "The Sydney Morning Herald"—and technical radio articles for the "Listener In."

John came to Sydney in 1932 to join the staff of "Wireless Weekly," forerunner of the present "Radio, Television and Hobbies." Engaged to answer technical queries, he later became assistant to the technical editor, then technical editor.

RADIO TALKS

Part of his duties in those days was to give weekly talks and to answer technical problems over Radio 2UE.

Also over 2UE John shared in presenting regular Sunday evening broadcasts entitled "Serenade to Music." At his home in Chatswood John spent a great deal of time experimenting with pick-ups, amplifiers and loud-speakers, and, just before the war, was concentrating on achieving stereo effects by frequency separation methods.

These activities, aimed at the very best presentation of recorded music, culminated in the formation of the Sydney Recorded Music Society, of which John was a foundation member.

In April, 1939, "Wireless Weekly" became a purely program weekly, and its technical activities were separated into a monthly magazine, "Radio and Hobbies." From being technical editor at its inception, John became editor a few months later—a position which he held till his death.

John Murray Moyle, prewar.

Officer in the R.A.A.F.

At the stereo demonstration, Sydney Conservatorium, 1959

Actually, John was missing from the editorial table during the war years 1941 to 1946. Joining the R.A.A.F., he rose to the rank of Squadron-Leader and was in charge of all radar publications at the Melbourne headquarters.

It is hard to see how anyone with lesser training could successfully have devised Service manuals from the unordered and often highly secret documents relating to radar equipment of the day.

SENIOR MEMBER

As an indication of his technical standing, John Moyle was elevated to the classification "Senior Member" by the Institution of Radio Engineers, Australia.

On his return to civilian life and to the editor's desk, John poured all his energies into "Radio and Hobbies" and allied activities.

He took over the record review section and built it into one that had unique reputation for combining keen musical appreciation with informed technical appraisal.

Along with this went tireless investigation into amplifier equipment. He hailed the L.P. disc at a time when many were casting doubts on its potential.

When the Postmaster-General's Department released frequencies for civilian use, John Moyle, aided by the staff of "Radio and Hobbies," built and put into service Australia's first newspaper V.H.F. mobile radio-telephone system. What stories could be told of the early experiments using modified gear during the winter evenings of 1948!

The equipment which came out of those experiments is still in service with the Sydney "Sun."

During 1956 John went overseas on a fact-finding tour for the magazine, mainly to do with television and audio. He came back firmly convinced that stereo records would sweep the market within a very short time. He was able to publish facts and figures which, at the time, were news to the very leaders of Australia's radio industry.

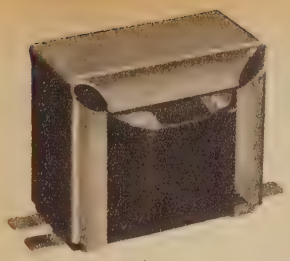
Later, in association with the "Audio Society," he gave demonstrations which will long be remembered by all who heard them.

John's work as an amateur is well known. Possibly no callsign was more quickly recognised than VK2JU, both on the air and by its association with numerous pieces of amateur equipment described in this magazine.

One of the "old gang," John served with the N.S.W. division of the Wireless Institute, as councillor and president, held Federal office, and was largely instrumental in drafting the uniform constitution.

Finally, he was selected as W.I.A. representative to the I.T.U. Conference at Geneva—a task which became a race with death.

John passed away on March 10. He is survived by a wife and two daughters.



FERGUSON

MEDIUM FIDELITY OUTPUT TRANSFORMERS

(1) **OPM SERIES—40-12000 C.P.S. ± 2 db.** (2)

FERGUSON offer a complete range of reasonably priced MEDIUM FIDELITY OUTPUT TRANSFORMERS ideally suited for radiograms, record players, public address amplifiers, etc., where the use of a higher priced true high-fidelity type is not justified.

TYPE No.	NOM. POWER (WATTS)	PRIMARY IMPEDANCE (OHMS)	SECONDARY IMPEDANCE (OHMS)	MTG. STYLE
OPM1	5	S.E. 7000, 5000	15, 12.5, 8, 3.7, 3.1, 2	1
OPM19	5	S.E. 7000, 5000	500, 250, 166, 125	1
OPM20	5	S.E. 10000, 8000	15, 12.5, 8, 3.7, 3.1, 2	1
OPM2	7	P.P. 10000	15, 12.5, 8, 3.7, 3.1, 2	1
OPM3	10	S.E. 4000, 2500	15, 12.5, 8, 3.7, 3.1, 2	2
OPM4	10	S.E. 4000, 2500	500, 250, 166, 125	2
OPM5	15	P.P. 5000, 3000	15, 12.5, 8, 3.7, 3.1, 2	2
OPM6	15	P.P. 5000, 3000	500, 250, 166, 125, 100	2
OPM7	15	P.P. 10000, 8000, 7000	15, 12.5, 8, 3.7, 3.1, 2	2
OPM8	15	P.P. 10000, 8000, 7000	500, 250, 166, 125, 100	2
OPM10	25	P.P. 8000, 6600	15, 12.5, 8, 3.7, 3.1, 2	2
OPM9	25	P.P. 8000, 6600	500, 250, 166, 125, 100	2
OPM14	35	P.P. 8000, 6600	15, 12.5, 8, 3.7, 3.1, 2	2
OPM11	35	P.P. 8000, 6600	500, 250, 166, 125, 100, 71	2
OPM13	55	P.P. 3500	15, 12.5, 8, 3.7, 3.1, 2	2
OPM12	55	P.P. 3500	500, 250, 125, 83, 62, 50	2
UNIVERSAL TEST SPEAKER				
OPM15	10	P.P. or S.E. 10000, 7000, 5000, 2500	3.1	2
LINE TO VOICE COIL				
OPM16	10	500	15, 12.5, 8, 3.7, 3.1, 2	1
OPM17	15	500	15, 12.5, 8, 3.7, 3.1, 2	2
OPM18	25	500	15, 12.5, 8, 3.7, 3.1, 2	2

Individual data sheets on all types available on request.

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NEWS AND VIEWS OF THE MONTH

Oven temperature

IN biscuitmaking long conveyor-type ovens are used, the biscuits being carried on an endless band. It is not practicable during baking to measure the temperature of the biscuits or the atmosphere throughout the oven by the usual means, as access to the oven is limited and trailing wires or tubes would interfere with production.

Equipment for temperature measurement designed by Mr R. H. S. Riordan, of the C.S.I.R.O. Engineering Section, Highett, Victoria, overcomes these difficulties.

A temperature-sensitive device is connected to a miniature radio transmitter, which travels through the oven on the band with the biscuits. A copper wire aerial inside the oven picks up the signal from the transmitter and takes it to a receiver outside the oven, where it is converted to a temperature reading on a meter or recorder.

Transistors powered by mercury batteries are used in the transmitter, which is insulated to withstand temperatures as high as 300 degrees Centigrade for up to 20 minutes.

The receiver incorporates novel filtering circuits to separate the transmitted signal from heavy interference caused by the electrical sparking apparatus which ensures continuous burning of the gas jets heating the oven.

This permits an accurate temperature reading which would otherwise be impossible.

★ ★ ★

Discharge lamps

THE pattern of colours which can be radiated by the atoms of an element is referred to as its spectrum. To produce a spectrum with the colours sharply defined, a discharge lamp of a special type must be used.

In the past, the production and operation of such lamps has been difficult and they have been used only in specialised research laboratories.

Mr W. G. Jones and Mr A. Walsh, of the C.S.I.R.O. Division of Chemical Physics, Fishermen's Bend, Victoria, have recently designed simple lamps to give the spectrum of any required metal.

Known as hollow-cathode lamps, they operate from a supply of 600 volts D.C. and draw currents of 5 to 100 milliamps. Each lamp has electrodes of two different metals, and each of these, when it is made the negative, can provide its own spectrum.

The lamps have been designed primarily for use in methods of chemical analysis based on atomic absorption spectroscopy. These methods, pioneered by Mr Walsh and his colleagues, are becoming widely used both in Australia and overseas.

The lamps are useful in many other applications where the spectrum of a metal is required. They are now being manufactured under licence by Ransley Glass Instruments, Melbourne, and have already been supplied to several overseas laboratories.

Tacky doormat

A NEW kind of doormat, made in Britain and primarily intended for use in factories, really does clean dirty boot and shoe soles. In a recent experiment a man wiped his feet in the dust and walked over one of the new mats on to white blotting paper. The blotting paper showed no trace of a footmark.

The secret of the mat is a smooth cloth surface coated with a special varnish that never dries quite hard, and in which tackiness is so nicely balanced that it strips the dirt of shoe soles without making them sticky.

When the mat collects so much dirt that it loses its tackiness, another cloth cover can be fitted.

★ ★ ★

Supersonic whips

MANY people think that the noise of a whip cracking is caused by leather slapping leather as the tip of the whip comes round and hits the main part. But, in fact, the noise is a superisonic bang.

Dr Trent, of the U.S. Naval Research Laboratories, who has written a paper on whip cracking, said that he first thought about the matter when he was standing in a queue and two men in front asked him to settle an argument as to what made this familiar noise.

Realising that the sound was very much like a shock wave, Dr T answered, on intuition, that it was ca by the fact that the tip of a w travelled faster than the speed of so Afterwards, being a scientist, he felt had to test the theory by experim with high-speed film.

Pictures of the tip of a whip mo at 1,400 feet per second and expos at one-millionth of a second of cha in the density of the air, established the tip of the whip did, in fact, through the speed of sound and cau shock wave.

★ ★ ★

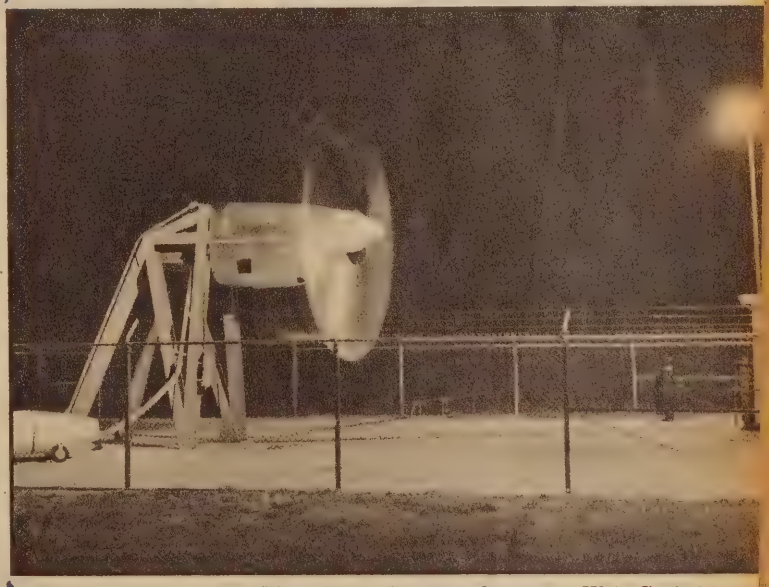
Lighting the Canal

FOR the first time in its 45-year tory, the Panama Canal will ships from ocean to ocean by nigh well as by day. The darkness tha to now has prevented the operatio its three locks after nightfall will be pelled by 750 G.E. fluorescent lights rently being installed.

The six-foot two-lamp units, norm used for street lighting are b mounted atop the walls of the lock 20-foot aluminium poles. The poles hinged at their bases to enable ther be swung outward for the passag especially wide vessels.

The new lighting will be a boo shipowners, since it will put an en costly delays occasioned by nightly c downs.

PROP-JET "FLIES" ON THE GROUN

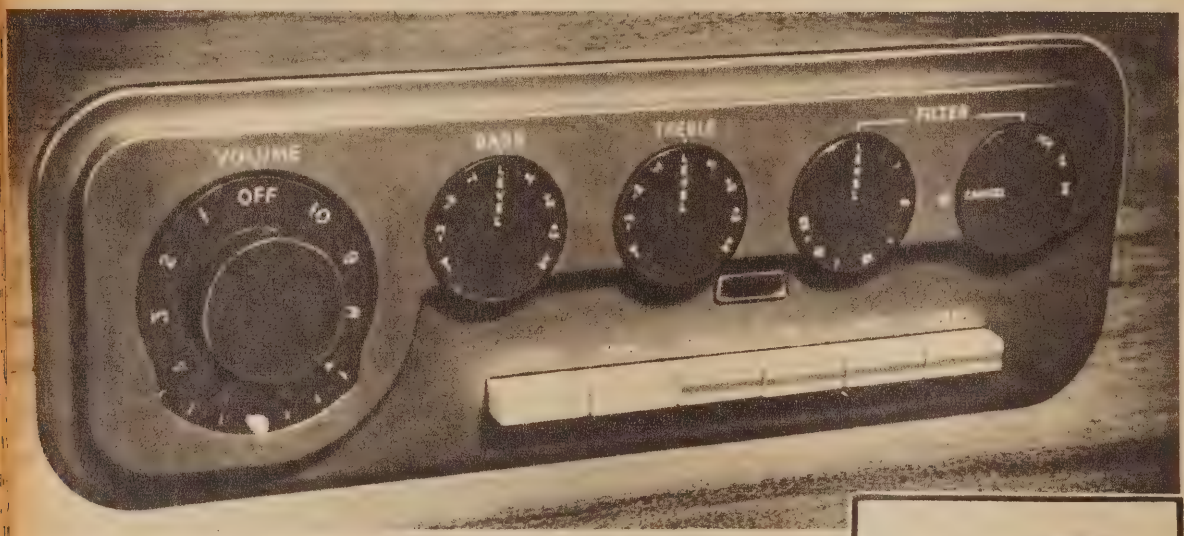


ON its stand at the Allison Flight Research hangar at Weir Cook Munic Airport, Indianapolis, an Allison Model 501 prop-jet engine for c mercial airliner use undergoes tests around the clock.

Paralleling ocmmercial airline practice, the engine is run through reg complete cycles from start, taxi, take-off, climb-out, cruise, let-down for la ing, and shut down. Some "flights" are of short duration, while others longer "flights."

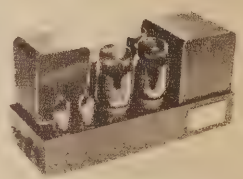
The Model 501 prop-jet engine is suitable for the Lockheed Electra c mercial airliner. Engine and propeller produce 3,750 horespower and w only 1,650lb.

Control Panel of *World's Finest* Stereo amplifier



QUAD 22

Incorporating the newest design refinements and greater flexibility of input, the Quad 22 is designed for monophonic and stereophonic reproduction. Quad 22, the world's finest Control Unit, has separate volume and balance (for stereo) controls, bass and treble controls, filter slope and filter switch.
Quad 22 operates from radio and microphone, disc and tape, single track and stereo. Matching is provided for any pick-up.
Select input by depressing one or a combination of the four right-hand buttons, choose any of four play-back characteristics from gramophone, then listen to "the closest approach to the original sound." And remember, this magnificent achievement is from a unit similar in size to the Quad II Control Unit. Price: £64/15/-.



QUAD II Amplifier

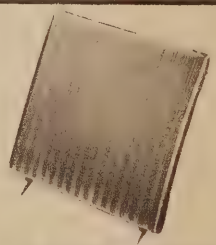
Use one Quad II amplifier with your Quad 22 Control Unit for monaural, or two for the finest stereo.
The finest amplifier in the world, the Quad II produces 15 watts of undistorted power throughout the range 20-20,000 c/s. Price: £61/5/-.

F.M. Tuner

Operates in conjunction with Quad 22 Control Unit and amplifier through your hi-fi speaker system. Tuner indicator shows a tuning error of one part in 10,000. Extremely low distortion and high-noise rejection. Price: £61/-/-.

A.M. Tuner

Also operates through Quad amplifier and hi-fi speaker system. Response is incredible when the quality of its source is considered. Modulation frequencies up to 12 Kc./s. are accepted: Long and medium wave bands. Price: £61/-/-.



QUAD Electrostatic Loudspeaker

Completely distortionless reproduction in rooms from 1,000 to 5,000 cubic feet. This is not "spectacular hi-fi" — it's designed for completely natural, non-fatiguing "pure fidelity," so important to serious music lovers of all types. 70° optimum listening area. 45 c/s.-18 Kc/s. Price: £159/10/-.

Prices quoted are retail and fixed in all State capitals.

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Water carrier

A MOBILE cylindrical tank which will hold six gallons of drinking water was described recently in a B.B.C. program. Known as the Aquaroll, the tank is made of aluminium, anodised to prevent rust and so keep the water free from contamination.

There is a rubber tyre round each end of the cylinder and a detachable handle, which makes it as easy as a lawnmower to roll along. There is also a detachable stand that lifts the tank clear of the ground, in the same horizontal position, and allows it to revolve freely, so that the water can easily be poured out.

The spout has an air vent that gives a smooth flow, and this special pourer is interchangeable with a device for connecting the tank to a sink pump through a half-inch hose when the cylinder has to be filled.

The whole thing, empty, weighs only 17 pounds and, without the handle, measures just a foot and a half in each of its three dimensions.

★ ★ ★

3D television

AN advanced system of stereoscopic closed-circuit television has been developed by E.M.I. Electronics Ltd. to meet the requirements of nuclear plants and other establishments where dangerous materials have to be manipulated remotely.

E.M.I.'s stereoscopic equipment utilises the company's standard closed circuit units and consists of two camera channels mounted side by side and arranged to relay pictures on to two monitors. The pictures from these are then superimposed on each other by means of a mirror and polarised glass to form a single image.

When viewed with polarised spectacles this produces a realistic three-dimensional picture.

★ ★ ★

Diesel fumes

FUMES from the exhaust pipes of buses and trucks that run on diesel oil are blamed for a lot of the air pollution in large cities. What may be an answer to the problem has been developed by the Vigsol Oil Company of London.

Called Vitasul, it is an additive for diesel fuels; a chemical compound that acts as an envelope round the injurious particles in the exhaust and not only eliminates their smell, but prevents them from coming into direct contact with human beings.

Apart from this safeguard, the new additive improves the engine's performance by reducing its fuel consumption and neutralising the traces of sulphur in diesel oil which shorten the engine's working life.

Vitasul does not necessarily banish smoke, but it's chemically cleaner in the sense of being safer than it would be otherwise.

One gallon of Vitasul costing a few shillings is added to 150 gallons of oil and the makers claim that, by making it easier for the fuel to atomise, it improved consumption by anything between 2 and 10 per cent.

MONTHLY NEWSLETTER

Dear Readers

Before we start our newsletter for this month we draw your attention to our advertisement appearing elsewhere in this issue and trust that all of you will take the opportunity to call and visit us in our new showrooms. Our wholesale and retail spare parts department should be quite a help to many of you, particularly those living in the southern and eastern suburbs, requiring spare parts or components for all radio and television work. Please note that we are open on Saturday mornings.

Orders over £5 to retail customers will be delivered free of charge anywhere in Melbourne, same-day service. Trade orders of any amount will also be delivered, but here a special service for parts required in a hurry is available. Orders placed before 10 a.m. will be delivered by 12.30 p.m., and orders placed before 1 p.m. will be delivered before 5 p.m. We trust that many of you will take advantage of this service.

We are also happy to announce that we are in a position to supply a full stock of transistors in most brand names, including a good supply of previously hard-to-get imported jobs for R.F. application. In addition, a full range of Zener diodes and Thermistors is carried in this new department, along with all components for Radio and Hobbies constructional work.

Our audio and stereo department is bigger and better than ever and we have also branched into marine electronics engineering, covering a full range of echo sounders, radio direction finders, rev. counters and small boat radar, as well as tele-communication equipment.

Continuing some English hi-fi news: We have been amazed to see lately a great amount of Norwegian and American equipment appearing in the British shops. Evidently some release of importing restrictions in England has made this possible and it is very noticeable that a large number of would-be buyers have re-considered their decisions on the home products and are turning to the imported field. It seems strange! Apparently they think, like ourselves, that the grass is always greener

Also here in Australia the releasing of import restrictions should make our showroom shelves appear very attractive by early winter, for it will, naturally, take six to seven weeks for the new lines to appear but we can really promise you some surprises, as we are holding many overseas agencies and will therefore be the first in this country with much of the new equipment released. Some nice American tape recorders are also expected, priced at a very reasonable figure for stereo use and, unlike their Australian or English counterparts, will be able to record in stereo without additional accessories. These machines, from Concert Tone of California, are beautifully made and we are very impressed with their quality. At the moment we have one on test in our workshops and it is, in many ways, better than most machines to which we have become accustomed, although you will realise no machine is perfect.

We notice two of the English manufacturers of small note are swinging their power amplifiers back to the old "Parry" Cathamplifier circuit. Why I would not know. Not that there is anything seriously wrong with this set-up, but nevertheless, by next issue we will probably see the product and be able to judge for ourselves.

We notice also that Leak control heads are coming out in a new dress and appear very attractive to the man with an eye for beauty (not of the female kind).

That is all for this month. Again we extend a welcome to you to visit our showrooms.

Yours,

United Electronics (A/Asia) Pty. Ltd.

31-33 Camberwell Road, Camberwell Junction.
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Phone: 211-4501

Here is the complete instrument housed in our standard small instrument case. It is probable that a commercial etched panel will be available shortly.

A Simple, Reliable Audio Oscillator

Here is a simplified Audio Oscillator which should meet the requirements of the many audio fans who desire a relatively inexpensive but accurate instrument. Very low distortion and constant output over a frequency range of 20 c/s to 500 kc/s combine to make it a most attractive proposition.

By John Barker

R any serious testing of audio equipment, an audio oscillator is the basic ument.

is possible, of course, simply to n to the sound, when the equipt is reproducing from some source, as a record or microphone, and le that the results are either good ad or just mediocre.

FICULT PROBLEM

t it is difficult to decide just what rouble is, and in what part of the it is arising, if some dissatisfacis felt with the output quality.

is helpful to have the use of some indicating device, such as VTVM multimeter, but conclusive results often be drawn withou the aid of instruments.

rge peaks or troughs in the rese of amplifiers and loudspeaker enres, or distortion above a certain level or over a certain frequency range, can generally be located by the sole use of an audio oscillator, such as the one to be described.

The main requirements of such an oscillator may be stated fairly simply; the frequency range must be wide enough to analyse fully the response of the equipment under test, the output should be fairly constant, and the distortion should be as low as possible. In presenting this design we feel that we have more than filled these requirements, and at a cost which is well within the reach of the average enthusiast.

As regards the frequency coverage we considered it necessary that the oscilator produce from below 20 cps to about 500 kc. This we have achieved in five bands with a ten-to-one frequency range on each band.

At first sight an extension of the high frequency output much above 20 or 25 kc/s may seem rather pointless, but there are valid reasons for this.

It is very necessary to be able to judge the response of an amplifier well into the supersonic regions in order to discover the presence of incipient instability, due to peaks and odd feedback effects. The response of a good amplified may well extend to 500 kc, anyway.

The use of square waves for testing amplifier performances has become very popular in recent years, and a very good method it is, but a high quality CRO is also required to examine the results.

HARMONICS

The square wave contains, theoretically at least, an infinite number of harmonics of the fundamental frequency. Therefore, by examining a square wave of some particular frequency, after it has been passed through an amplifier, we can tell, broadly, what is happening over a wide range of frequencies, from the fundamental up.

With a good oscilloscope, effects can be seen on a 5 kc square wave, which relate to peaks and dips in the response in the region 50-500 kc.

This was discussed in some detail in the articles, "Amplifier Response and Stability" in the November and December, 1958, issues of this magazine.

However, much the same information may be obtained with the aid of our wide range oscillator and a VTVM, even if not quite so quickly. For this reason and in order to keep the cost right down to a minimum, we have not included the extra components required to produce square waves.

Similarly, for such an instrument, there is no urgent need for an output level meter, provided the output is constant over the whole range. The user may then set th level once and forget it. Otherwise it can become very annoying to have to move the VTVM from the output to the input to check the level every time the frequency is changed.

LEVEL RESPONSE

Our new oscillator is flat within less than 1 db over the whole range, with a maximum output of 5 volts R.M.S.

The distortion content of the oscillator output is the next consideration. The degree of distortion allowable depends on the quality of the audio gear to be tested, the nature of the tests and the

type of associated test equipment likely to be used in conjunction with the oscillator.

For the home constructor whose other equipment may only run to his own two ears and a VTVM at the most, and who aims at only moderate amplifier quality, distortion content is not so critical.

He will be mostly interested in searching for peaks and troughs in the output of his equipment and generally gaining some idea of the response of the various component sections.

On the other hand, for critically testing high quality amplifiers with maximum distortions of about 0.1 per cent, the oscillator must have very low distortion indeed. To achieve this result, an enormous amount of care must be taken with the design, and tunable filters are sometimes required at the output of the oscillator, further to reduce the harmonic content.

TYPICAL PERFORMANCE

Fortunately, any procedures designed to produce constant output and increase the stability of an oscillator such as ours, also tend to improve waveform. Distortion content is of the order of 0.5 per cent, which compares very favourably with the general run of commercial instruments.

Bearing in mind the requirements of the instrument it was necessary to choose a suitable basic circuit.

In August and September of 1955 we described a full-sized audio signal generator featuring both square and sine wave output, an accurate output level indicator, low distortion and wide range. This has proved a very popular instrument and some hundreds have been built.

The heart of this instrument was a Wien Bridge R/C oscillator, using two high-slope television pentodes, type 6BX6. We therefore decided, without much ado, to adapt this circuit for the present design.

The main advantage of the Wien Bridge circuit is that the frequency of oscillation is inversely proportional to RC, unlike most other resistance/capacity oscillators where the frequency is inversely proportional to the square root of RC. This allows more than a ten-to-one frequency coverage per band, and hence a minimum number of bands to cover the desired range.

REACTIVE BRANCH

The reactive branch of the Wien Bridge is the most interesting and important section of the circuit. It is shown in Figure 1.

It can be shown that at one particular frequency Fo, determined by the values of R1, C1, R2, C2 the output voltage, Eout, is in phase with and is equal to one-third of, the input voltage Ein. At all other frequencies Eout is out of phase with, and less than a third of Ein.

This basic property is utilised in the bridge circuit of Figure 2. Here the other two arms of the bridge are supplied by the resistors Rth and Rk. We have assumed R1 equal to R2 and C1 equal to C2, which is the usual case any way, the values being designated simply as R and C.

The so called "resonant" frequency is then given by the formula in Figure 2.

Input to the bridge is supplied by the generator G, and is applied ac points AB. The output is taken fr points CD and is applied to the in of the valve V1.

Now suppose we make the resista of Rth twice that of Rk. Then, at resonant frequency, the voltage ac Rk will equal the voltage across po CB, which will in turn be equal to

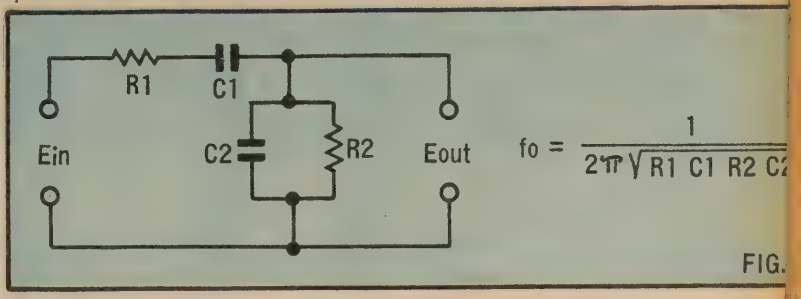


FIG.

This is the basic circuit of the reactive portion of the complete bridge. These four components determine the oscillator frequency which is calculated by the given formula.

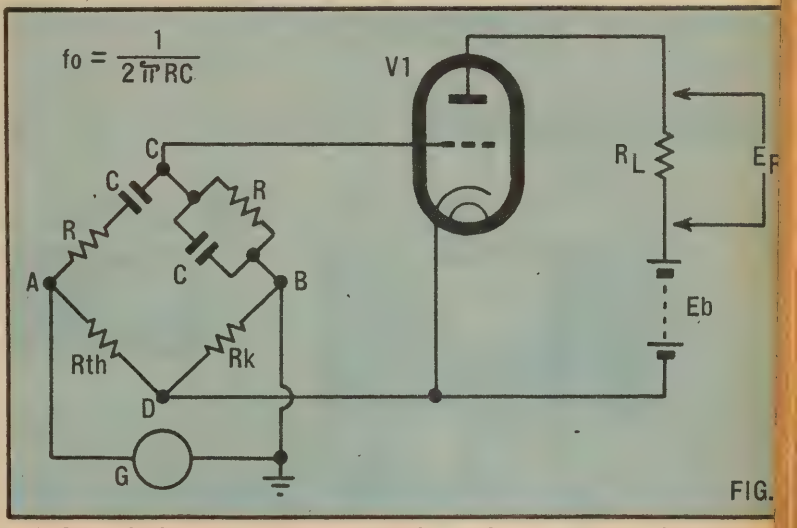
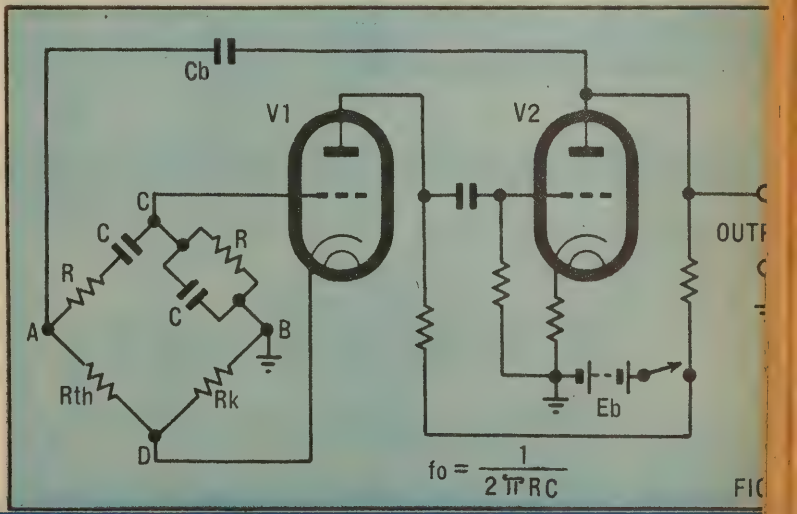


FIG.

A basic bridge type circuit commonly used in measuring instruments. Output voltage Er is zero only at the one frequency which is dependant on the values of the network components. With equal values of R and C it is known as a "symmetrical" network.



FIG

This is the basic circuit from which the final design was evolved. This diagram does not show the feedback paths as clearly as the final circuit.

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Outstanding in all four areas of stereo cartridge performance.

- Full, flat frequency response, 20 through 20,000 cycles plus or minus 3 db (Model VR225).
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- New stylus assembly for optimum compliance and precision tracking.
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Model VR227 with .7 mil diamond stylus—£18.0.0.
Model VR225 with .5 mil diamond stylus. Price to be announced.
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STEREO AND AUDIO LEVEL INDICATORS

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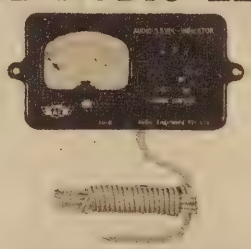

Monaural types, £4/17/6 each.

Designed for high and low impedance use. Ideal for checking balance and output level of stereo or mono equipment. Can be used to indicate recording level on tape or disc, to check balance at output of pre-amplifiers, tuners or individual amplifier stages. Alignment and frequency response measurements can be simply made with accuracy.

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UNDOUBTEDLY THE BEST VALUE in turntables today!

All four models available feature the NEW Thorens ultra-precise drive mechanism, giving absolute freedom from WOW, FLUTTER and RUMBLE.

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Prices range from £35/10/- for the manual TD134L to £70/-/- for the Transcription Model TD124L. Fitted with low mass tone arms, 17 c.p.s. resonance. Universal 5 pin plug-in shell allows instant wiring of stereo or mono cartridges. Prices do not include cartridge.

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third of the generator input voltage. What is more they are both in phase with respect to point B.

Now when two equal, in phase voltages, are applied to the grid and cathode of an amplifier valve, the output at the plate (Er in the diagram) will be zero.

If the frequency of the generator, or the value of any of the components of the bridge is changed, an out of balance voltage will appear at the input of the amplifier and Er will be other than zero. This is the basis of the many bridge circuits of this type used to measure frequency, resitance, capacity, etc., in so many instruments.

FURTHER DEVELOPMENT

Now if we add a few components and rearrange things a little, we arrive at the circuit of Figure 3. The bridge input voltage is supplied by the output of valve V2 through the large blocking capacitor Cb. V2 is merely amplifying the output of the valve V1.

It will be seen that the voltage fed back through Cb is in phase with the input to the grid of V1 so it constitutes a positive or regenerative feedback.

At resonance the voltages developed across points CB and DB are also in phase with the feedback voltage so that oscillation will occur when the voltage across CB exceeds that across DB.

So long as Rth equals twice Rk nothing happens, but if we make Rth a little larger than twice Rk, an out-of-balance voltage appears across points CB, which is amplified and fed back from V2 to point A. This out-of-balance voltage can be caused by any stray thermal activity or disturbance in the circuit. It is the "starter" for most oscillatory circuits.

If the oscillator were left in this condition, the level of oscillations would rise indefinitely, only being limited by the saturating level of the valves. The frequency of the oscillations is still determined by the value of R and C. An output may be taken from the point shown.

If we were to leave the circuit as it is, we would obtain an output whose distortion level was high, due to the valves operating near saturation level, and which was very unstable.

It is therefore necessary to introduce a measure of automatic control in order to limit the operating level to a more desirable figure. The best way to achieve this appears to be with the aid of a thermistor, several types of which have appeared on the market in recent years.

THERMISTOR

A thermistor is a special type of resistor in which the resistance varies enormously with temperature. As the temperature rises, so the resistance falls.

The temperature may be changed either by a variation in the surrounding air temperature or by changing the electric current passing through the thermistor. Curves are published by the manufacturers showing power input plotted against resistance for the various standard types.

If, in the circuit of Figure 3, we use a properly chosen thermistor for Rth we will have an automatic control of level.

When the circuit is first switched on, Rth will be greater than twice Rk and the stray out-of-balance voltage at the grid of V1 will start off the oscillations. As the output of V2 rises, so the current fed back to the bridge through Cb to Rth increases also. The temperature of Rth rises, its resistance drops and the oscillation level drops proportionally.

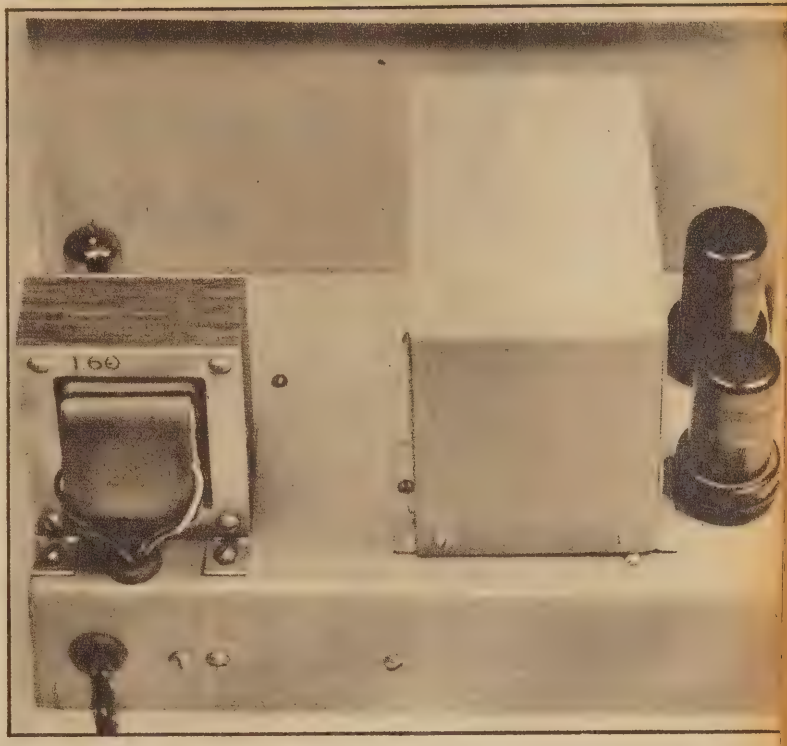
However, the resistance of Rth can only drop to some point just in excess of twice Rk, otherwise the oscillation would cease altogether, since the bridge output would disappear when Rth equals twice Rk. Therefore, Rth continually adjusts its resistance so that oscillations are just maintained.

The resultant level of the output voltage is substantially independent of plifier gain, frequency of operation in fact, most variables other than tremes in the temperature of the roundings.

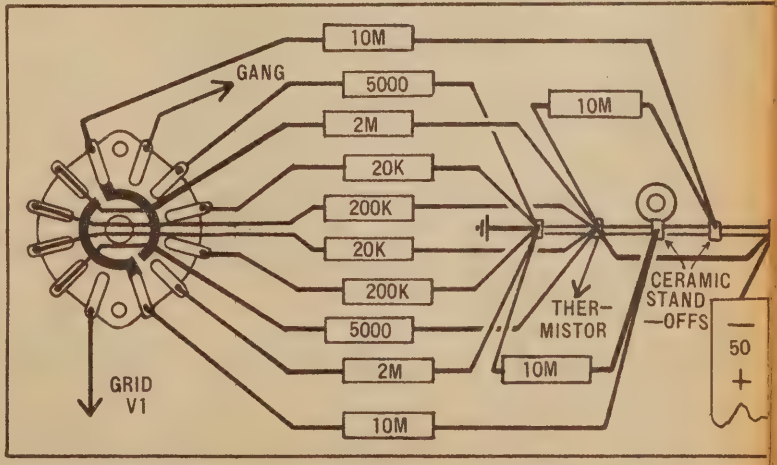
This very heavy negative feedbac the cathode of V1, together with selective nature of the bridge cir results in the output waveform b substantially free of harmonic di tion and very stable over the whole quency range.

It will be seen from an examina

REAR VIEW OF THE OSCILLATOR



The power transformer is mounted as far to the left as possible, and the amplifier to the far right. The shield around the gang helps reduce stray hum pick-up. The rectifier can be seen immediately behind the transformer.



This is a schematic layout of the wiring of the band switch. By referri to this, and to the underneath chassis view on page 43, you should able to follow our method of wiring. Upper resistors are drawn a lit to the left.

PUBLIC ADDRESS AMPLIFIERS

DUAL OPERATION MAINS OR BATTERY

Type PA828 amplifiers may be operated from 240 volt or 6 volt battery supply, changeover being effected by alternate cables which are stowed in rear of housing. A standby switch is provided to conserve battery life.

5 WATT AMPLIFIER

TYPE PA 828

20 WATT AMPLIFIER

TYPE PA 829

Type PA829 20 watt mains or 12 volt battery amplifier provides all facilities necessary for P.A. Hiring.

These include two microphone channels with third optional channel for microphone or pickup. Either high or low output pickups can be used. Features include a battery saving switch and a bass cut switch to control L.F. response when using horn speakers. A plug-in V.U. meter and monitor speaker with their associated switches are ancillary units.

FOREMOST IN SOUND

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of the published thermistor curves that the sensitivity of the thermistor to resistance change, with change of power input, decreases with higher power input levels.

Therefore, it is best to operate the thermistor at a small power level in order to achieve maximum control of the oscillator output. If it is expected, however, that the air temperatures of the area in which the oscillator is to operate will vary widely, particularly in an upward direction, then a less sensitive part of the curve must be selected. A reasonable compromise would be about 30 or 50 mW.

In order to provide a convenient variation of output frequency, either the two Cs or the two Rs are varied together. It is generally more desirable to use variable capacitors and switch resistors to change bands, rather than to use variable resistors. A variable capacitor is mechanically smooth and reliable and has higher re-set accuracy over a long period.

TUNING CAPACITOR

For frequencies in the audio range a standard receiver type, two-gang capacitor may be used to vary the frequency in each band, selected by switched resistors.

If the gang has a sufficient maximum to minimum capacitance ratio a 10-to-1 coverage can be expected. To achieve this, the maximum capacitance will need to be at least 450 pF in order that the minimum plus the stray capacitance does not reduce the ratio below the necessary margin.

Another matter which concerns the gang as well as the wavechange switch is leakage resistance.

For the very low frequencies the frequency determining resistors in the input network have very large values, in our case 20 megohms.

Any leakage from the fixed plates of the gang, or from the switch contacts, or from the tag strips upon which the resistors are mounted, to earth, will effectively shunt the high value resistors and alter the frequency.

If this were a constant condition, we could compensate for it, but unfortunately it varies with the humidity and the type and shape of the materials of the switch, etc. High quality insulation is the only remedy, together with careful mounting of the components.

HIGH NEGATIVE FEEDBACK

Since the output voltage is independent of the amplifier gain, we can afford to design for a high gain. Then the large negative feedback necessary will bring about an increased waveform purity. The maximum amplifier gain is limited, however, by the necessity of keeping the required input voltage above the hum level expected.

Unfortunately, the gain of V2 is limited to some extent because of the input impedance of the bridge, which is connected in parallel with its load resistor. The input impedance of the bridge is about three times the value of Rk for most of the frequency range, so the anode load for V2 will be limited about the same figure.

The feedback capacitor to the bridge needs to have a small reactance at the lowest frequency required. Fifty uF is quite adequate. The screen dropping resistors, where used, should be well bypassed and the inter-stage coupling capacitor should be large enough so as not to attenuate lowest frequencies.

Sometimes there is trouble in this type of oscillator with beats between the oscillator output and the mains frequency or its harmonics. This will be evidenced by a periodic variation or pulsing of the output amplitude just on either side of 50, 100 or 200 c/s.

If it can only be detected at 50 c/s it is almost certainly due to hum picked up from the filament line. If it is seen at 100 c/s and up, it will be due to insufficient filtering in the power supply or perhaps to hum pick-up through capacitive coupling with power supply components.

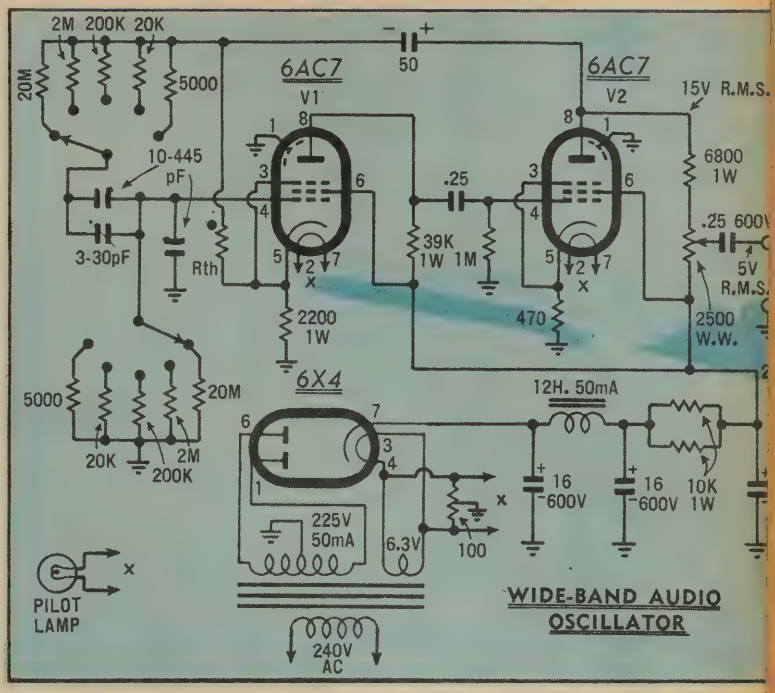
Unless the case is to be unduly large for such a simple instrument it is difficult to effectively isolate the power supply from the oscillator section, so some precautions have to be taken to guard against stray hum pick-up.

HUM PRECAUTIONS

The transformer and filter choke should be mounted at the end of the chassis remote from the amplifier input and, if possible, a metal shield should be fitted under the chassis between the supply components and the amplifier input.

Fifty-cycle hum is frequently caused by capacitive coupling between the filaments and cathodes of the amplifiers. If a small variable resistor is connected across the filament supply, with the slider connected to earth, the effect can be cancelled out to a large degree by adjusting the slider for least hum.

FINAL CIRCUIT OF OSCILLATOR



The complete circuit. Other similar high slope pentodes may be used wi extra screen supply components where necessary. With the filtering sho the hum level is negligible.

One hundred cycle hum is be duced by careful attention to supply filtering. High values of c tance, and sometimes an extra R/C tion, are indicated.

Single point earthing helps r earth loops, which are sometim source of trouble. The mains earth all the earthed sides of the compo are brought to the same point clo the bases of the amplifier valves. this earth system is earthed to the c at the point which produces least in the output.

So much for some of the preli considerations. The final circuit is s on page 41.

DISPOSALS VALVES

The two valves we have used instrument are 6AC7s which are rently available through dis sources for only a few shillings. are high Gm television pentode ideal for this task. Any similar may be used. Our previous osc used 6BX6s but they are not so tive from the price angle.

The two-gang capacitor is a type with ceramic bead insulatio having a rated maximum capac 450 pF.

As will be seen from the photo it is mounted on three perspex about ¼in high, which helps capacitance to earth.

Two large holes, in our case ¾i meter, are punched in the chassis diately beneath the gang for the necting leads. This reduces th capacity.

An aluminium shield box

Dual

STEREO

PRECISION-BUILT CHANGERS and PLAYERS

1006 STEREO CHANGER

The manifold functions and superior reproduction of this model will surprise every Hi-Fi enthusiast. For operation as a changer, automatic player and two methods of studio style manual operation.

FEATURES. Push button operation—stereo key—manual key—built in weight scale and regulator—rumble free 4-pole motor—11in dia. Hi-Fi turntable — interchangeable cartridge holder to suit all cartridges with standard fitting —supplied fitted with DUAL CDS 420 cartridge for Stereo and LP records.

1007 STEREO CHANGER

Modern styling, exceptional sound reproduction, universal operation either as a fully automatic changer, fully automatic or manual single player for all record sizes, simple and sturdy construction securing the utmost in reliability are the outstanding features of the DUAL 1007.

FEATURES. Push button operation, start, stop and repeat —four speeds—tonearm lock—self stabilising change spindle—outstanding high fidelity reproduction through the DUAL Piezo-electric pickup system CDS 520—Stylus pressure 5/6 grms.

1004S STEREO CHANGER

Outstanding in sound quality, versatile in application, automatic indexing of record sizes and extreme comfort of operation are the most agreeable features of the DUAL 1004S.

FEATURES. Push button control, start, stop and repeat—stereo key—pickup arm lock—fitted with Dual stereo cartridge CDS 320—stylus pressure 5/6 grms.

300 STEREO PLAYER

Outstanding quality of reproduction both stereo and monaural records, sturdy construction and modern styling are the dominating feaures of this record player.

FEATURES. Four speeds—pickup arm lock—turntable brake. Available fitted with CDS 320/3 stereo cartridge or or monaural application the CDS 310/3 cartridge.

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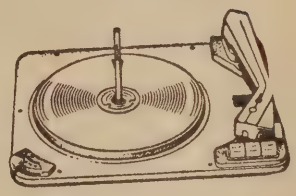
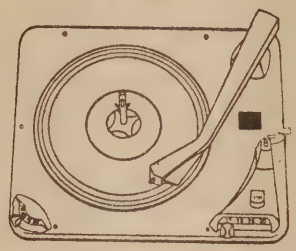
1006



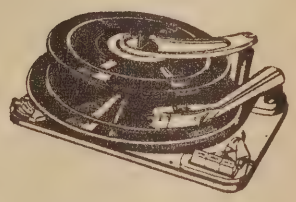
£39/12/-

1007



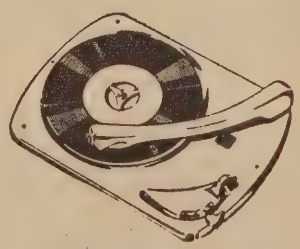
£26/15/-

1004S



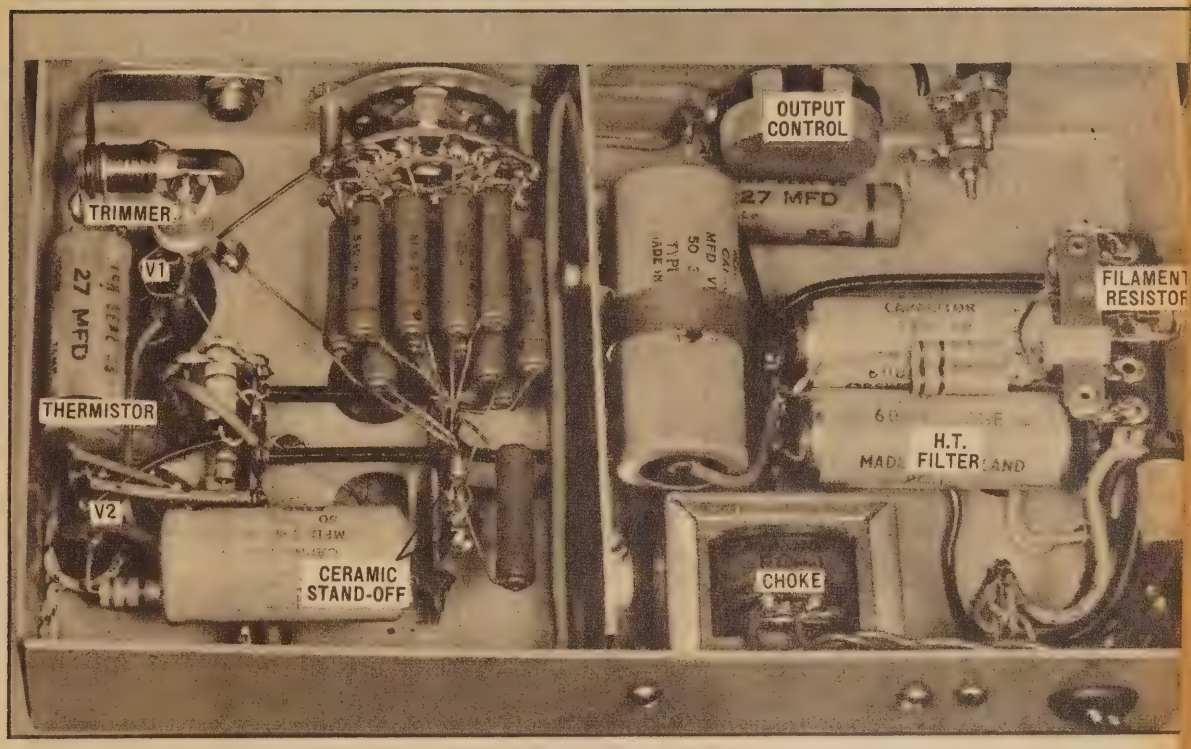
£37/9/6

300



With Stereo Cart. £21/5/-
With Mono Cart. £18/16/3

UNDERNEATH VIEW SHOWS THE WIRING DETAILS



Most of the important wiring is visible in this view. The main thing in an instrument of this type is to be careful of the placement of components so as to keep stray hum pick-up to a minimum.

shaped to fit around the gang, as shown, to minimise stray hum pick-up. It measures 3¼in high, 3in across and 4¼in back to front.

A flexible coupling is used to connect the shaft to the dial knob. This coupling has ceramic insulation, again in the interest of low leakage.

The wave-change switch is a five-position, two-pole type, preferably with ceramic insulation. These are not always in stock but can be ordered in quite easily. In fact, we did not have one ourselves in time for the photographs so that an ordinary bakelite type was used, but we intend to replace it as soon as possible. This has not caused any trouble so far.

The frequency determining resistors should be high stability types with a 1 per cent tolerance. The 20 megohm resistors are generally not obtainable, so they may be made up from two 10 megs. The junctions of these two resistors are soldered to two ceramic stand-off pillars, to reduce leakage effects.

LAYOUT DIAGRAM

To aid in the wiring of these resistors, we have produced a layout diagram of the switch, resistors and tag strip. It appears on page 39.

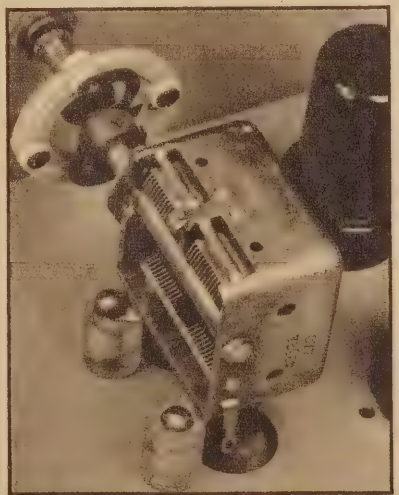
The resistors, which are nearest the camera in the under chassis view on page 43, are shown to the left in the diagram. The ceramic stand-off's are soldered to two of the tags on the five-pin tag strip.

The resistors should not be jammed together, neither should they be mounted too close to the chassis.

The valve sockets for the 6AC7's are oriented so the keyways are pointed to the left as seen in the under chassis view. Then the filament leads may be run around the outer edge of the chassis out of the way.

The 50 uF feedback capacitor is quite big physically and should be mounted well clear of the chassis. This also applies to the lead from the 6.8K resistor at the plate of V2 to the output pot.

The thermistor is mounted on a heat sink made up from scrap brass. This tends to keep the thermistor at some reasonably even temperature. The brass bracket is screwed to the chassis betw the two amplifier valves and can seen in the under-chassis view. T pieces of brass are shaped and solde together so as to make a pocket betw them for the thermistor.



Variable capacitor with cover removed. Note the perspex pillars and the flexible coupling with the ceramic insulation.

The thermistor is the same as the specified for the 1955 Audio Genera which was type A54. With the cathode resistor of 2200 ohms it dissipate about 24 milliwatts. This be a little on the low side for opera under very hot conditions but, normal use, it is quite adequate. reason for its choice is that it sh be freely available at the many supp who handled parts for the prev generator.

STRAY CAPACITANCE

A small trimmer is connected a one side of the gang. This is to pensate for the added stray cap which will appears across the other of the gang. These strays will vary every different oscillator built. The mer allows the frequency coverage altered slightly to make the pointer with the dial scale which is to be r duced next month.

The actual output from the pla the second valve is about 15 volts To avoid undue shunting by the ext circuit, the plate load was divide the proportions shown. About 3.5 RMS now appears across the output trol pot.

The oscillator is housed in our instrument case. The chassis mea 8 7-8in across, 5¼in back to front 2in deep. It is held to the front par the terminals, pot, switch, and ind bezel.

(Continued on Page 152)

Ortofon PICKUP ARMS AND HEADS

Illustrated, the ORTOFON pickup arm type SSM 212 with the pickup shell type G. Adjustment of needle pressure can be made by turning the counterweight. A scale on the counterweight is calibrated to show the stylus pressure in grams. The G shell will take all ORTOFON cartridges and the standard cartridges of other makes.

RECORD ROUND-UP ALL OVER THE WORLD

Seldom do you find one particular make of audio equipment in universal use. Reason is that it takes a really good product, keenly priced, to sell against world-wide competition. Now consider the case of ORTOFON. Here is a range of pickup arms and heads to match every conceivable application. Here is a precision instrument, manufactured in Denmark and commanding top place in the world markets.

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In the United States, Electro-Sonic Laboratories, a subsidiary of ORTOFON, are set up to manufacture the many combinations of pickup arms and heads for the American market alone. And ORTOFON research continues to guarantee the finest instruments for record reproduction in the professional and domestic fields. Check the facts of ORTOFON performance, versatility and value. Call on your local distributor for full technical specifications and demonstration.

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While visiting in America recently, GTV9 personality Panda interviewed Hugh O'Brian (star TV's "Wyatt Earp") over lunch in O'Brian's apartment. The interview, recorded on Fi-cord, w subsequently flown to Melbourne for broadcast by Channel 9.

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(b) 1 7/8in per second for extremely good voice reproduction, giving overall performance from input socket through tape to output socket.

Wow and flutter: 0.4 p.c.

Noise level: 35 db.

Recording time:
(a) at 7½in per second, 9 minutes per track, total 18 minutes per spool.
(b) at 1 7/8in per second, 36 minutes per track; total 72 minutes per spool.

Microphone:
Dynamic microphone with motor stop/start switch. Where a studio microphone is used in order to obtain full hi-fi results, the input impedance should be 400/1,000 ohms and an input of 0.4 millivolts is required fully to load the tape.

Power:
Four 2-volt accumulator batteries, weighing only 5oz, rechargeable with the special Fi-Cord charger from all normal A.C. mains supplies from 110-240 volts.

Battery life:
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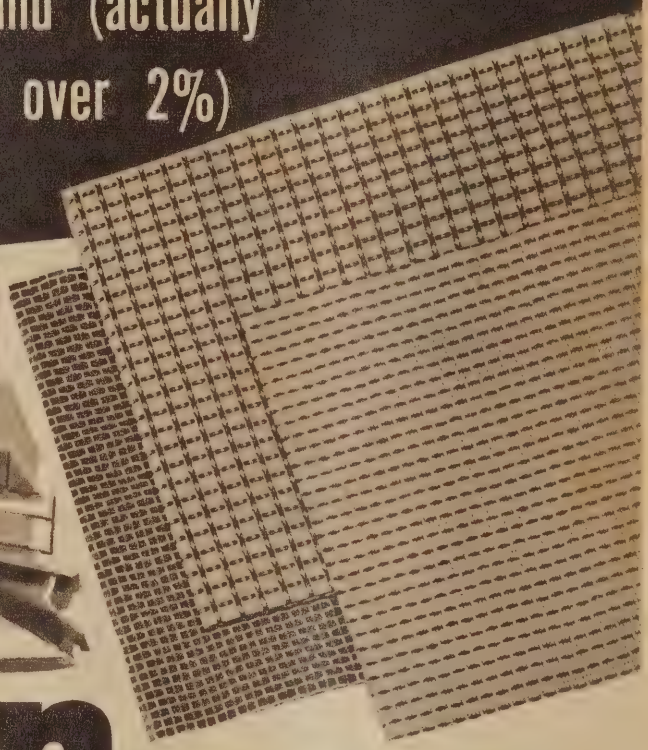

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QUEENSLAND
Chandlers Pty. Ltd., Albert Street, BRISBANE.
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VICTORIA
Electronic Developments, Nicholas Bldg., 37 Swanston Street, MELBOURNE.
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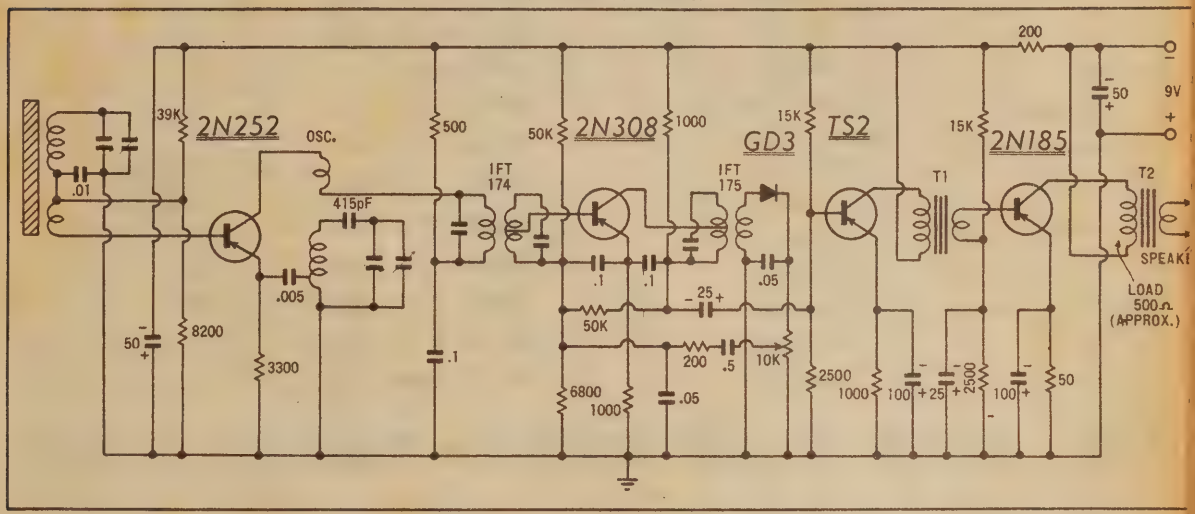
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

5-TRANSISTOR PERFORMANCE FROM 4 TRANSISTORS

Here is a circuit for a 4-transistor receiver, partially based on our "Transporta Six" and using a reflexed transistor stage. Submitted by Mr O. Andersen, P.O. Box 257, Rockhampton, Qld., it may be of interest to other readers.



Describing the circuit, Mr Andersen says:—

"Because of its economy in transistors, it is simple and inexpensive to make and serves as a useful portable. It makes use of the circuit of the "Transporta Six" which you previously published but has a single output transistor.

"The 2N308 serves a double purpose; it acts as an audio driver as well as an RF amplifier. The arrangement gives 5-transistor performance from a 4-transistor set.

"The set is similar in range and selectivity to the 'Transporta Six'; the maximum volume is much less but still sufficient for a portable set.

"Battery consumption is about 10 to 12mA on no-signal and appreciably less on station. The alterations to the circuit of the 'Transporta Six' can be clearly seen in the diagram and mainly involves alteration of the AVC lead.

"The audio end has a 3 to 1 audio transformer but, no doubt, the 8,000 to 20 ohm transformers now available will serve equally well. The speaker transformer has a minimum impedance of 500 ohms and is available commercially."

GASSY 5BP1 CRT'S

A reader from Brisbane, Q., suggests that it may often be possible to salvage disposals 5BP1 CR tubes which have become gassy due to long storage. The method is simply to apply deflection voltages to both plates to produce a raster of some kind and let them run with about 3,000 volts EHT.

SUCCESS STORY—1959 T.V. SET

Mr H. Rose of 304 Kangaroo Road, Auckland, N.Z., claims to have no knowledge of radio, yet he successfully constructed our 1959 TV receiver. Here is an account of his efforts:

"I am a new reader of your excellent magazine and I would like to congra late you on your wonderful 1959 article and circuitry.

"I would like to state that I do know the first thing about radio. I h never even built a crystal set. I understand the meaning of the syml in a radio circuit but find it very h to follow it through.

"However, on seeing the circuit of 1959 TV set, with all the block diagra I decided to have a go at building same.

"It may surprise you to know th did the whole job in three days.

"One of my expert friends had b me a 17in set using a component ma facturer's circuit but it was not successful. After several other exp had a go at it I decided the best t to do was to pull the whole thing bits, get a new chassis and do the myself.

"I did have to get some help, part larly on the power supply side, a used the old transformer and recti I had a Q-Plus tuner and four-stag strip from the previous set and these parts again, as well as most o components.

"I was unable to get the new w coil so had to make do with the one. Anyway the set now works fectly on the three experimental sta here in Auckland. One on Chann and the other two on Channel 6."

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Batt. S/W Converter	1	12. Transigram		26. 25 Watt P.A. Amp.		40. V.T.V.M.	
Batt. S/W Converter	2	13. Interstate (A.C.)	5	27. 35 Watt P.A. Amp.		41. R/C Bridge	
Batt. All Wave Converter	2	14. Miniature (A.C.)	5	28. Transistor 10w Amp.		42. 50 Mc/s Converter	
Reinartz (A.C.)	1	15. Dual Wave (A.C.)	5	29. Hi-Fi 3 Amp.		43. 144 Mc/s Converter	
S/W 3 Band	3	16. Dual Wave (A.C.)	6	30. Hi-Fi 5 Amp.		44. M/M 1000 ohms/volt	
S/W (A.C.) Converter	1	17. Globespan (A.C.)	8	31. Mullard 3-3 Amp.		45. M/M 20,000 ohms/volt	
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		21. Transistor	3	35. Twin 5 Stereo Amp.			
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		23. Transporta	6	37. Twin 17 Stereo Amp.			

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HI-FI 3w. Amp. £12/17/6	13w P.A. Amp. £14/2/6	25w. P.A. Amp. £21/12/6	R/C BRIDGE £21/12/6

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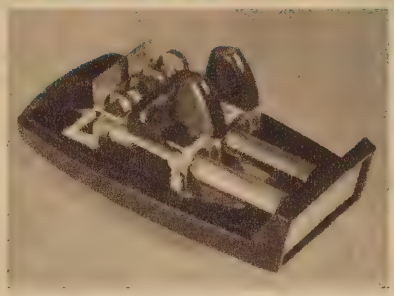
HOW SON-R TV TUNING OPERATES

Recent Television Receivers released in Australia under the "Admiral" brand-name incorporate a remote tuning control system in which a completely independent, non-electrical remote unit is employed.

THE system uses ultrasonic audio waves to act as the connecting link in the control circuit. The ultrasonic waves, far higher in frequency than audible sound waves, are generated in the hand-held control unit and are picked up by a microphone in the receiver, where they are used to operate relays controlling various set operations.

The "Son-R" control unit contains two short brass rods, which are machined so that they vibrate at above-audio frequencies when struck. The unit has two push-buttons and, when each is pressed, it causes a small hammer to strike the appropriate rod. The rods used are tuned to frequencies of 38.285 and 39.285 Kc/s and are thus 1 Kc. apart in frequency.

The small, completely self-contained transmitter unit fits neatly in the hand. Pressure on either button initiates the required function; volume adjustments or channel selection.



The transmitter unit with cover removed. The press button assembly and the resonant brass rods are clearly visible. No electronic circuitry of any kind is used.

In the receiver, the sounds are picked up by a crystal microphone mounted behind the escutcheon plate on the front of the set, and passed to a small subchassis in the receiver. There the signal is amplified in a four-stage amplifier which has a bandwidth covering both frequencies used.

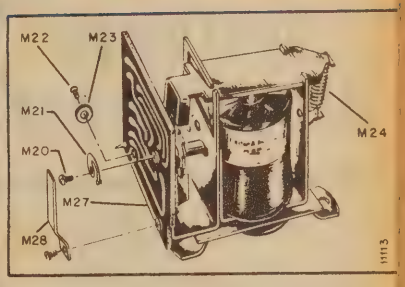
SUFFICIENTLY SENSITIVE

This amplifier also is fitted with its own A.G.C. system, which prevents it from overload in the presence of a very strong input signal, but allows it to be sufficiently sensitive to respond to relatively weak signals.

From the amplifier, the signal passes to a discriminator, very similar electrically to a normal "F.M." discriminator. The discriminator is arranged in such a way that one frequency causes a DC output of a certain polarity, while the other frequency produces an output of the opposite polarity.

As the discriminator is coupled "push-pull" fashion to the grids of two relay control valves, this means that each frequency operates one valve only, thus separating the signals.

The relays in the anode circuits of the



Detail drawing showing the volume control relay. The rachet and pawl mechanism may be seen just behind the printed circuit switch contact assembly. The unit provides three sound levels and an "off" position.

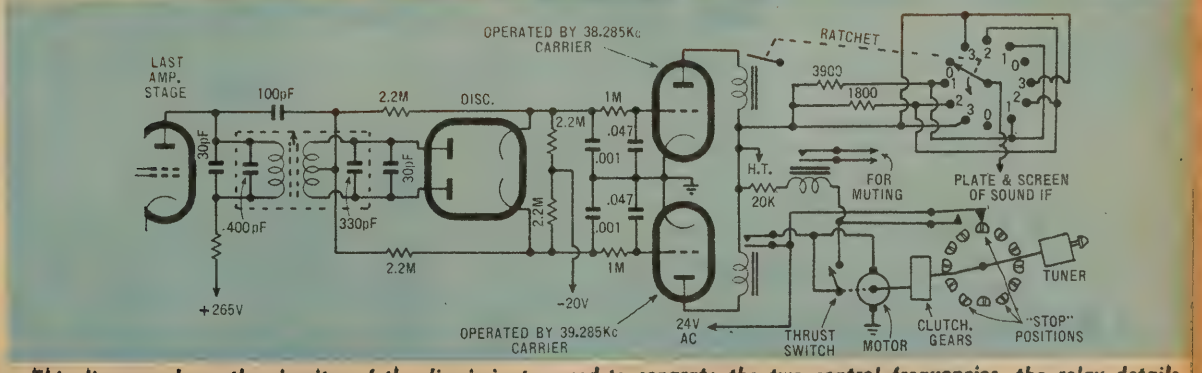
two control valves perform the required functions in the receiver. The relay corresponding to the lower frequency operates a step switch via a pawl and ratchet device. This switch varies the plate and screen voltages on the sound I.F. valve, thus controlling the volume of the set.

Four volume settings are available, being off, low, medium and high, but the actual intensity of the sound is set by the volume control in the normal way.

The switch used, by the way, is rather unconventional in that it is printed on a plastic board, and thus requires less torque than a conventional switch of the built-up variety. As the diagram shows, it is made as an integral part of the relay.

The second relay, corresponding to the higher frequency, sends an electric pulse to a 24-volt AC motor geared to the turret tuner shaft. Contacts attached to the tuner operate in such a way that the motor then rotates the tuner until it reaches the next preset channel where it stops. Adjustable nylon stops on an indexing wheel enable the desired stopping positions to be set at any future date if new channels appear.

The picture is blanked out while the motor is changing channels and the sound is muted at the same time. This is arranged by means of a friction driven thrust switch, which also is used to con-



This diagram shows the circuitry of the discriminator used to separate the two control frequencies, the relay details, and the operational switching used in the control amplifier mounted in the television receiver. As can be seen, the discriminator is arranged so that one carrier operates one relay tube, and the other carrier operates the remaining tube.

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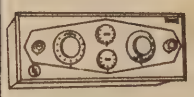
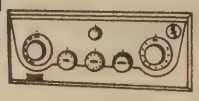
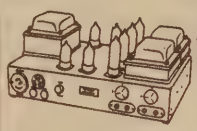


STEREO INTEGRATED AMPLIFIER TYPE STD/444. This amplifier brings stereo into a moderate price bracket for those who demand equipment of high engineering standards combined with elegant requirements are not excessive. styling, but whose loudspeaker (8 watt.)



STEREO CONTROL UNIT PRE-AMPLIFIER STD/399 — 20 WATT STEREO SYSTEM STD/381. These two pieces of equipment (available separately if required) provide the core of a first-class installation. Whatever input sources and loudspeakers are chosen, the user may rest assured that they are associated with amplifier equipment beyond reproach.



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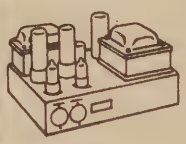

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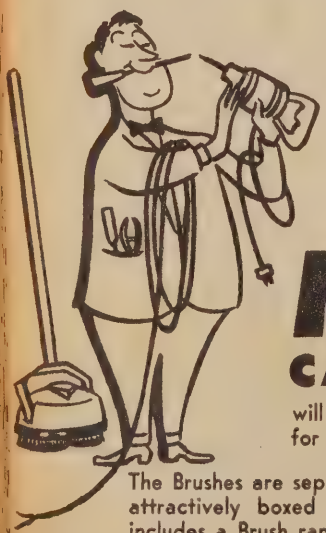

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plete the circuit for the motor "continue-to-run" contacts.

This means that, if the tuner is touched manually, the motor does not "take over" and whizz the tuner around to the next pre-determined channel. Because the motor is de-clutched when not running, the thrust switch is not operated by manual operation of the tuner, and so the "continue-to-run" contacts are not connected.

In short, the only way that the motor can be started is by a pulse from the related relay, and it will then continue to run via the special contacts until the next preset stop is reached. When the motor is running, a large swamping signal is applied to the signal amplifier, thus making it insensitive to signals during the moving period.

QUITE UNCANNY

The system is quite uncanny in operation and the absence of cords, batteries and other devices makes the unit a very good proposition. While it entails a relatively large number of extra components and does not provide a complete control of the receiver, it seems to represent a worthwhile advance in the remote-control field.

It is worth noting, however, that the scheme is not completely foolproof. Occasionally a noise pulse of the right frequency may be produced accidently, as by the jingling of keys etc., and this can cause a control to function unintentionally. Fortunately, such incidents are rare and the system appears to have a high order of reliability and adequate sensitivity for even the largest room.

"LAKE-WALKER" BUILDS BRIDGES

(Continued from Page 9)

always at the mercy of weather and possibly tidal conditions.

But the electric bridge builder solves such problems. When it has been floated into position, its three giant steel legs are lowered to the lake-bottom and the platform (or deck) rises to its necessary height, well above any possible wave action. So absolute stability is provided which cannot be affected by the weather.

As soon as one section of the bridge is complete, the platform lowers itself to the waves, and three giant feet are retracted, and the platform and crane are floated to a new forward position.

Most of us can visualise a weight of one ton. So we can perceive how powerful must be the crane which, forming a massive and vital part of the bridge-builder, is capable of lifting pre-stressed concrete beams weighing 250 tons each.

The crane derives its power from seven electric motors, which in turn get their power from dynamos driven by a battery of diesel engines totalling 1,200 h.p. Even the 8,500 feet of 1¼in steel cable, used to lift the loads, itself weighs 15 tons.

For all its massive size, its enormous power and ability to swing great loads at the end of a 210ft boom extending 65ft from its base, this crane pivots on a single steel ball and socket a mere 20in in diameter.

In operation, this bridge-builder will drill and set the pre-stressed concrete piles (some of which are 180ft long and weigh 100 tons), lift into place sections of the all-masonry bridge and do all this and much auxiliary work as well, irrespective of conditions.

If necessary, the platform can be put to other uses — as a mobile off-shore oil-drilling platform (with the crane removed), or as a construction unit on off-shore work — once the 100 million dollar bridge is completed.

Possibly the most unusual aspect of this mighty and massive "lake-walking" machine is its inbuilt ability to keep itself dead level while in operation. Should one leg begin suddenly to settle more than the other two, a warning horn alerts everybody while simultaneously the nine electric motors on that "sinking" leg begin to bring the platform level again.

The successful completion of the electric bridge builder's first project — the Maracaibo Bridge — will undoubtedly open up a new era of bridge-building throughout the world, and will make possible bridge projects hitherto rejected because of tidal and climatic obstacles.

STereo V

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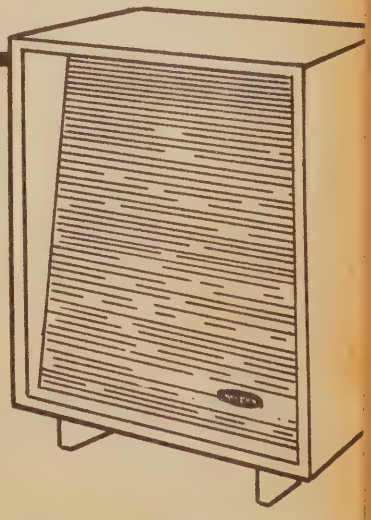

The Sherwood (custom built) Enclosure is designed that it can take almost any speaker or combination of speakers. It is finished in highly polished maple, walnut or rosewood to blend beautifully with surrounding furniture. Priced at only £24/10/-.
The Sherwood is also available in an "easy-to-follow" Do-it-yourself-Kit, priced at only £13/5/-.

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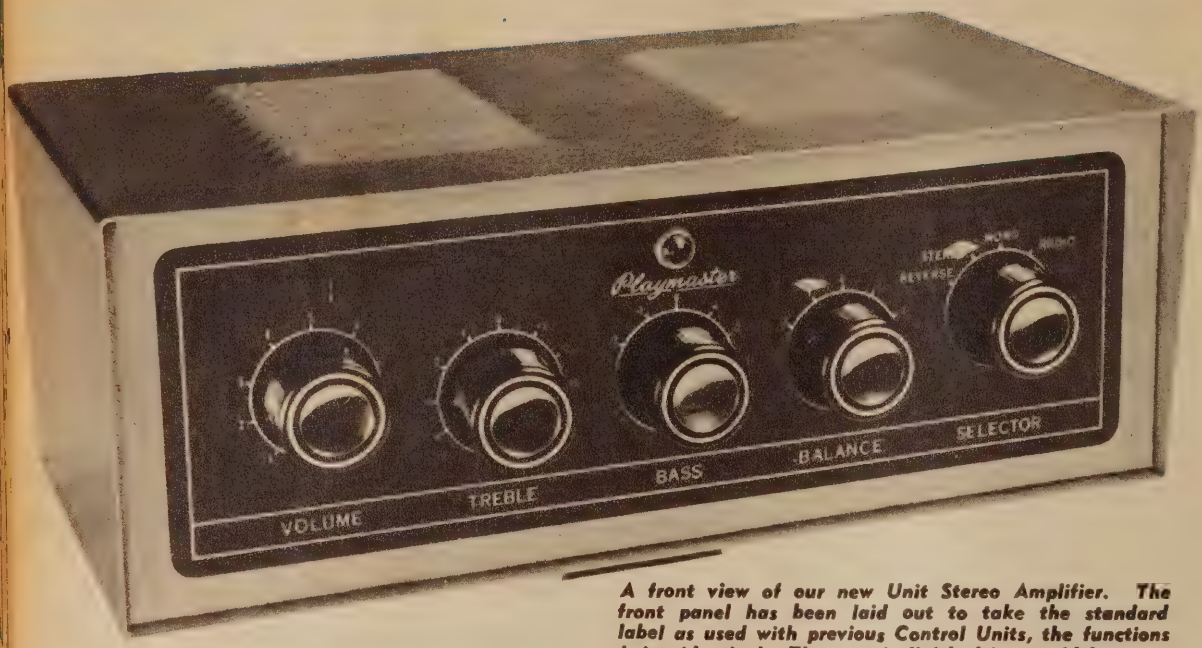


A front view of our new Unit Stereo Amplifier. The front panel has been laid out to take the standard label as used with previous Control Units, the functions being identical. The case is finished in a gold hammertone lacquer.

Single Unit Stereo Amplifier

The latest design trend in amplifiers—at least of the simpler variety — is to have the amplifier as a completely self-contained unit, housed in its own attractive metal case and standing in full view on a cabinet or bookshelf. Here, then, is our version of a simple but highly effective stereo amplifier built along these lines.

HE new approach appears partly to be the result of the general trend ard miniaturisation of components partly to meet the needs of those o must, of necessity, keep the size their gear to a minimum.

n any case, and whatever the cause, idea is undoubtedly becoming a very ular one overseas. Nearly all the ipment amplifiers currently being of- d conform to this style.

echnically, two important factors e made it possible to combine the trol and amplifier sections into a unit, ch, in terms of bulk, is not much more icult to accommodate than a conven- al Control Unit alone.

VO FACTORS

hese factors are (1) the availability miniature components and (2) the of silicon diode rectifiers, which ice both the size and the heat radia- from the power supply.

thus becomes practical to house the re amplifier in its own case, styled harmonise with household furnish- yet retaining a somewhat "techni- air.

he space saving advantage alone es a case for the new form of con- tion, which becomes doubly attrac- with a stereo system and the need ccommodate an additional speaker net.

Housed in a decorative lacquered metal case, the amplifier may grace your bookshelf, record player cabinet, or occupy any other convenient position.

Perhaps we should interpose here a couple of very practical remarks. Firstly, the whole success of the scheme depends on the finish of the equipment and its durability.

It is quite futile trying to use a case which has simply been coloured up with a lacquer spray, with no attempt at degreasing, undercoating or baking. Such a spray will flake and scratch at the slightest provocation, leaving the amplifier looking cheap and disreputable.

Secondly, it is quite essential for the case to have a liberal pattern of louvres at rear and top, small holes underneath and be supported on dimples or rubber feet. This will allow free movement of air through the case and keep operating temperatures within bounds.

by

Wes Yashin

It should not be inferred from the foregoing remarks that we have discarded the earlier approach and that all future amplifiers will follow the unit construction idea.

We are merely recognising that unit amplifiers have earned a place in the scheme of things and we can envisage two or three basic designs which should meet initial requirements.

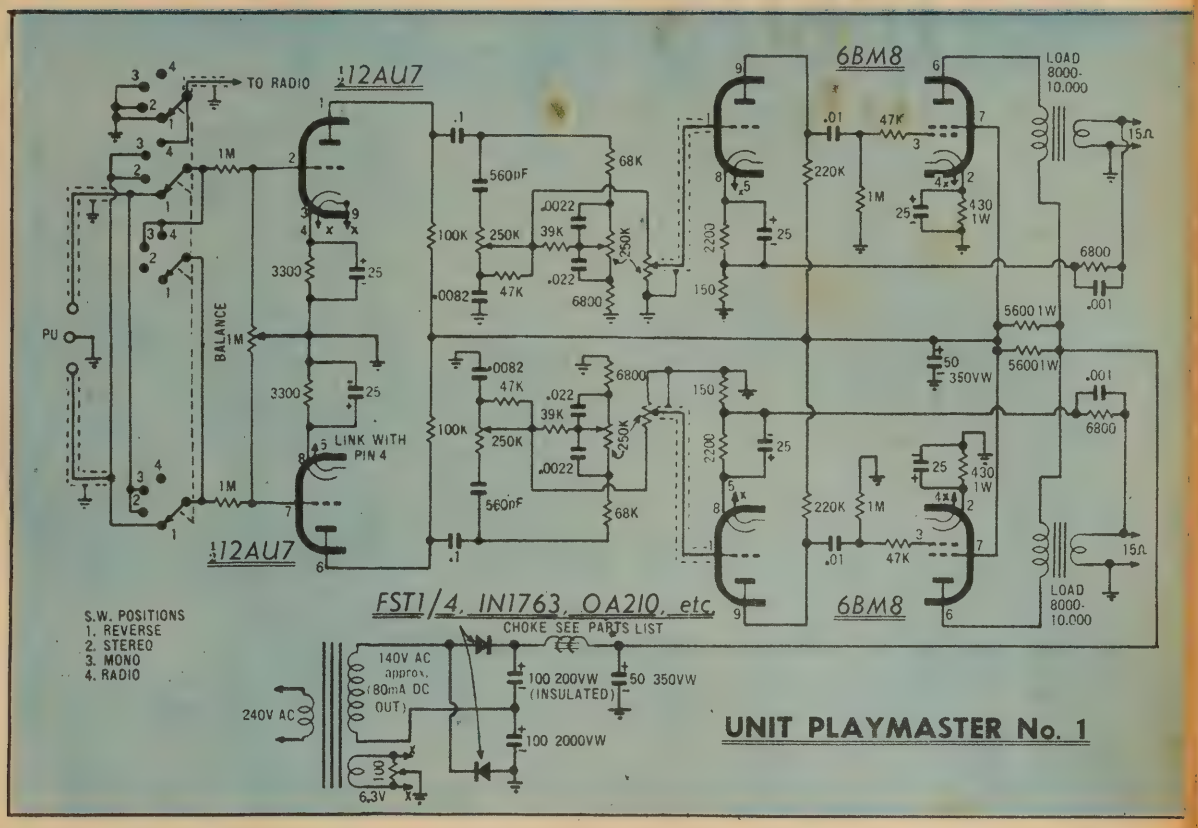
It must also be appreciated that "one chassis" construction has definite limitations. It must not be forgotten that the older idea of providing a separate chassis for amplifier and control unit was followed for a very good reason, namely, to minimise hum problems which might otherwise assume serious proportions in low-level signal circuits.

STILL VALID

This is still a valid argument, at least where high quality magnetic pickups are concerned, the output in some cases amounting to no more than a few millivolts. For the present, it would seem to be the best, if not the only approach in such cases.

Particularly is this so in home-constructed units. Whereas commercial production can control layout and lead dress to within very close tolerances, much greater variation must inevitably occur in the home-constructed amplifiers. In a borderline case, these variations may be more than can be tolerated.

CIRCUIT OF THE UNIT PLAYMASTER AMPLIFIER



The circuit is quite straightforward, being a combination of circuits used on previous occasions. A novel feature is the power supply which uses silicon power diodes. Resistors and capacitors used in the tone control network should be 5 per cent types and reasonably matched.

However, amplifiers designed for crystal pickups are another matter. By taking advantage of the substantially higher signal output, and by careful attention to wiring and layout, it is possible to take more liberties with layout. And, since the crystal pickup is more than holding its own in popularity, we might just as well take advantage of its characteristics to design the most convenient and compact unit possible.

SIMPLE CIRCUIT

The amplifier we are about to describe is a simple single-ended, twin-channel affair, employing perfectly conventional circuitry. Initially, we were concerned more with the purely physical problems of housing everything in a suitable space, than with producing any smart circuit tricks.

The design of a suitable case was one problem, since it had to be both functional and decorative. Due consideration had to be given to ventilation, method of assembly and access to the various terminals and sockets without sacrificing the appearance.

Some idea of the final result may be gained from the picture at the head of this article.

A complete stereo amplifier system, including the control circuitry, is housed in a neat metal case measuring only 12¼in x 4¾in x 7in. This is finished in gold hammertone, while an attractive anodised label with matching walnut and gold knobs sets off the front of the unit most effectively.

The result is a professional appearance of which any home constructor may be justly proud.

And, while we have concentrated on compactness and economy, no one need apologise for the performance. Used in conjunction with a good output transformer, the single 6BM8 can make plenty of noise in an ordinary room, particularly when, in practice, it is supplemented by a second channel capable of the same output.

In short, the sound quality is excellent, and may come as a pleasant surprise to those used to thinking in terms of much more elaborate equipment. It will certainly justify a pair of modern twin cone speakers, either 8 or 12in, each mounted in a suitable "boffle" or vented enclosure.

NEGATIVE FEEDBACK

Much of the success of simple circuits of this nature depends on the correct use of negative feedback, and this amplifier uses the well tried arrangement whereby signal is picked up from the voice coil and fed back to cathode of the driver valve. Used discreetly, this is one of the most effective feedback circuits.

The values shown are for a 15 ohm voice coil, and produce about 12 loss. 15 ohms is becoming a comm figure nowadays, even with the less pensive speakers, but if your spea should have an impedance in the 2-3 region, the feedback resistor would n to be reduced to about 2,700 ohms.

As usual, the polarity for nega feedback has to be established by and error. If connection of the f back makes the amplifier howl, or creases the gain, then the feedbac positive. To correct this condition, ply reverse either the primary or se dary leads on the output transfor but not both.

SILICON DIODES

Another circuit feature worthy comment is the use of silicon diode place of the conventional valve rect and this was aimed mainly at sa space, particularly in regard to the p transformer. These diodes reduce transformer size for three main rea

(1) A direct saving of watts previc required to operate the rectifier he (2) There is little wasted wattage d the voltage drop across the rectifier, normally supplied by the transfor (3) The use of a full-wave voltage d ler circuit requiring only a simple tapped HT secondary. The reducti such that it is possible to wind a

The WARBURTON FRANKI page

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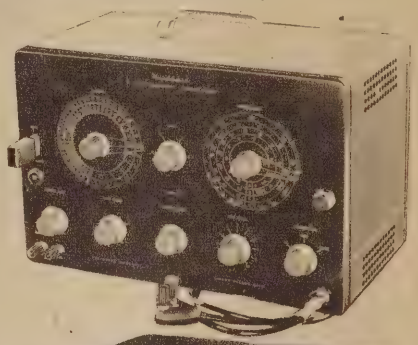

Provides the essential facilities required for alignment of FM, monochrome TV or colour TV sets. The all-electronic sweep circuit employs a controllable inductor, which varies frequency by magnetic means. Not only is this device trouble-free and consistent in performance, it also requires very little power to provide wide range sweeps with excellent linearity. The sweep circuit operates on fundamentals covering the range of 3.6 mc, to 220 mc in four bands. Features Built In 5.5 meg. Crystal and Variable Marker Oscillators. **£41/12/** plus S.T.

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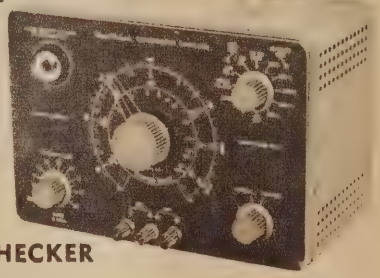

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A REAR VIEW OF THE STEREO AMPLIFIER CHASSIS

This rear view clearly shows the layout of the major components. The position of the output transformers is self evident, and the two 6BM8 valves are between them. To the right are two 100 mfd electrolytics, followed by the power transformer. Along the front edge of the chassis, just visible, is the filter choke, to the extreme left of which is the dual 50 mfd electrolytic and the 12AU7 preamplifier valve. The sockets along the rear lip are, left to right, the two pickup inputs followed by the radio input. To the right of these are the two speaker sockets.

mA power transformer on a core stack previously necessary for a 40 mA. type.

The saving in transformer cost is offset to some extent by the more elaborate combination of electrolytics, and the fact that two silicon diodes cost a little more than a conventional rectifier. However, against this, is the fact that silicon diodes should have unlimited life.

To keep the total current drain within the limits of an 80 mA transformer, it was necessary to increase slightly the output valve bias resistors. The values shown should set the total current drain at just below the 80 mA mark. Under these conditions, the useful power output from each channel should be between 2 and 2.5 watts, depending on the quality of the output transformer used.

MODEST GAIN

Overall gain of the 6BM8, with feedback, is quite modest, and the tone control stage adds very little, having approximately unity gain. However, we found the sensitivity adequate for most stereo crystal pickups, with just enough to spare.

Considering this, the 12AU7 appears to be the wisest choice for the control stage. A higher gain valve appears to be unnecessary and, particularly if a high output pickup is used, may even result in the plate voltage swing being driven into the overload region on peak passages. The control stage is specially vulnerable in this respect, there being

PARTS LIST

1 Chassis 12in x 6½in x 1½in.
1 Case, internal dimensions 12½in x 4½in x 6½in deep. Rear and top to be freely louvred, with a generous pattern of holes underneath. The depth of the top to exceed that of the bottom by ½in (i.e. 7in total).
1 Panel, with rolled edges, to fit internal dimensions of the case.
1 Control unit label, with 5 knobs to match.
1 Power transformer approx. 140 volts per side at 80mA, 6.3 volts at 2.25 amps.
1 100 mA, 6 Henry choke or similar.
2 Output transformers, primary 8000 ohms secondary to suit voice coil (A & R type 2558 or similar).
3 Noval sockets.
1 2x2x5 Oak switch.

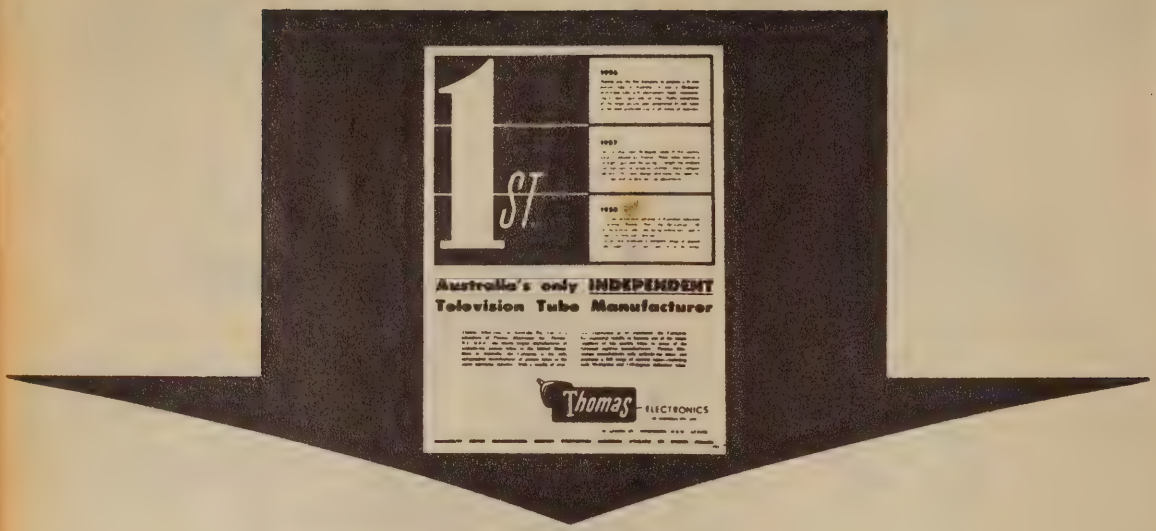
VALVES
2 6BM8. 1 12AU7

RECTIFIERS
2 FST1/4, 1N1763, OA210 &c.

CAPACITORS
2 100 mfd 200 vw electrolytics, one to be insulated.
1 2 x 50 mfd, 350 vw dual electrolytic.
2 25 mfd 25 volt electrolytics.
4 25 mfd 3 volt electrolytics.
2 .1 mfd 400 volt paper.
2 .01 mfd 400 volt paper.
2 .022 mfd 200 volt paper.
2 .0082 mfd 200 volt paper.
2 .0022 mfd 200 volt paper.
2 560 pf 200 volt ceramic or styroseal.
2 .001 mica or ceramic.

RESISTORS
2 5600 ohm 1 watt.
2 430 ohm 1 watt.
4 1 meg ½ watt.
2 220K ½ watt.
2 100K ½ watt.
2 68K ½ watt.
4 47K ½ watt.
2 39K ½ watt.
2 6800 ohm ½ watt.
2 3300 ohm ½ watt.
2 2200 ohm ½ watt.
2 150 ohm ½ watt.
1 100 ohm variable centre tapping resistor.
1 1 meg linear potentiometer.
3 250K log dual potentiometers.

SUNDRIES.
3 Utilux type input sockets, 2 4 pin speaker plugs and sockets, dial lamp holder with lamp and bezel, 1 8-lug tag strip, 1 7-lug tag strip, 2 5-lug tag strips, 2 2-lug tag strips, 6 grommets, length of 3-core flex and a 3 pin plug, tinned copper wire, spaghetti, hookup wire, solder lugs, nuts and bolts.



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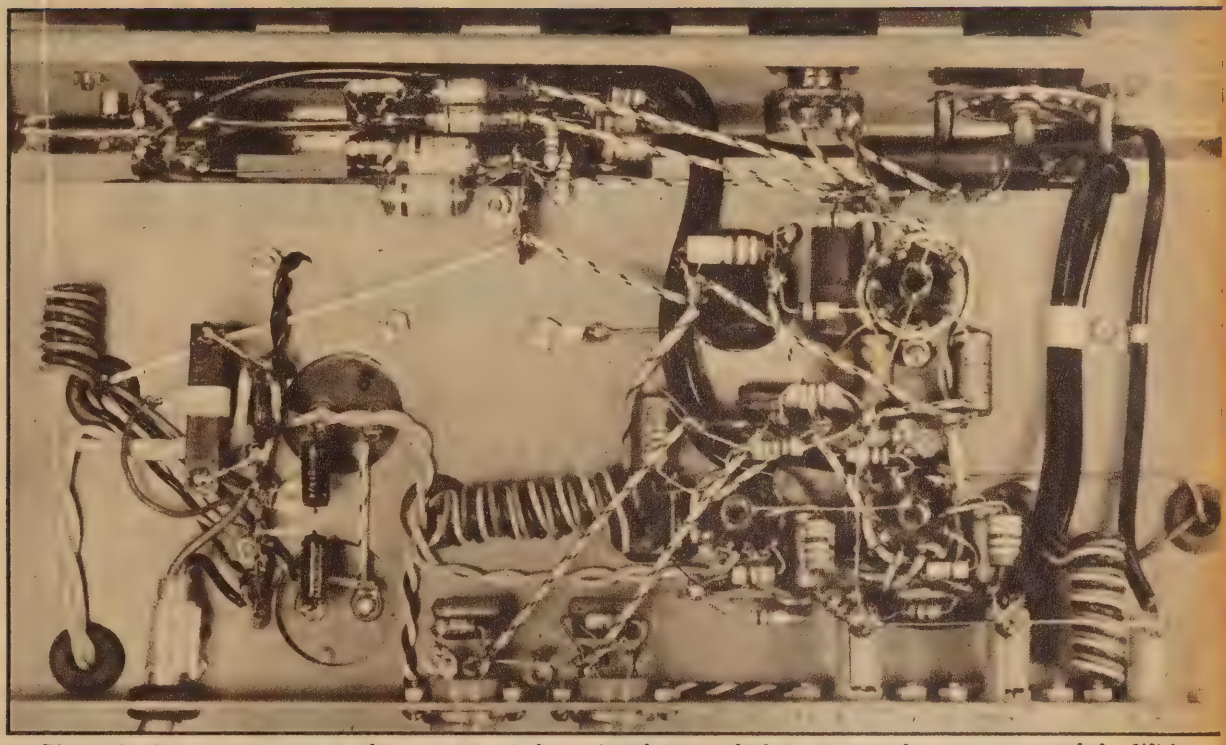
UNDERNEATH VIEW SHOWS THE WIRING DETAILS



The underchassis view gives a clear picture of the wiring layout, which is compact but not overcrowded. Wiring runs are mainly made by means of spaghetti-covered tinned copper wire while a liberal use of tag strips ensures a neat component layout. Do not forget to observe the single point earthing technique mentioned in the text.

no volume control ahead of it to give protection.

However, should the gain prove inadequate for any reason, two courses are open.

The first, and the least drastic, is to alter the value of the resistors in the earthy end of the bass control, from 6,800 to 10,000 ohms. This method provides a worthwhile increase in gain without seriously affecting the operation of the bass control.

The second course is to increase the gain of the preamplifier stage by using a higher gain twin triode. There are several lesser known twin triodes suitable for this purpose which may be treated, in this case, as plug-in replacements for the 12AU7. Among these are the 12AY7, an expensive medium mu non-microphonic type, the 12AV7, the 12AZ7 and the 12AT7, the last being an RF type and inclined to be microphonic.

VERY HIGH GAIN

Finally, there is the 12AX7, a very high-gain type. This valve would only be considered for a very low output crystal pickup.

The possibility of high frequency loss when using the higher gain valves might concern some but, on test, we found that even in the worst case, it was still within the scope of the treble potentiometer to correct, with several db of boost to spare.

The unit as shown, has been laid out to use the standard control unit label, with matching gold-centred knobs. The functions are identical with those in our high-quality control units and all the knobs are clearly marked.

The unit was built on a chassis measuring 12 x 6 x 1½in deep. The ends of the chassis are bent up to form brackets to which the front panel is attached. The front of the chassis is cut away to allow for the controls and their wiring, and the rear is bent down to form the rear lip. Chassis blueprints will be available in the normal manner, while the complete metal work should be available from at least one manufacturer.

THE CONSTRUCTION

Construction should commence by mounting the major components and the reproduced photographs should be of assistance in this regard. The power and output transformers must be mounted with their cores at right angles for minimum hum pickup.

Before commencing wiring, one point should be kept in mind. To minimise hum due to earth loops, we have employed a single point earthing technique, and we suggest that you do likewise.

Since the input sockets are necessarily "earthy," the various earth returns should be routed to finish at, or near the input sockets. This should not be difficult to accomplish with the aid of tag strips. "Earthy" wires from the earlier stages should not make contact with the chassis at any intermediate points.

Two groups of leads which need to be shielded are those from the input sockets to the function switch and from the volume controls to the grids of the 6BM8s. The leads from the balance control to the 12AU7 grids also are "hot," but are so short that shielding should not be necessary. Coaxial cable such as PT9M, is ideal for this application, being insulated as well as shielded and this is necessary to satisfy the single point earthing requirements.

In no circumstances should any of the shielded leads be allowed to run close to the power transformer, either above or below the chassis, as hum pickup will almost certainly result.

Looking at the under chassis view you will note that there is adequate space for the minor components, without overcrowding. However, when purchasing components, select the smallest available. These will assist you in preserving a neat layout.

WIRING TECHNIQUE

The wiring technique adopted for this unit is quite straightforward. Tag strips are used to support some of the components, while others are suspended between the tag strips and the appropriate valve socket pins. Wiring runs are made with hookup wire and spaghetti-covered tinned copper wire.

The incoming AC lead is anchored to a 7-lug strip, which also supports the low tension secondary leads together with the centre tapping resistor, and one end of each of the power diodes with the appropriate HT secondary lead

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Basis model of the miniature television pickup camera (size comparison with a wrist watch).
Maximum diameter 2 1/32 in. (53 mm), maximum length without lens 5 9/32 in. (145 mm), weight without cable or lens approx. 1.1 lbs. (.5 kg)

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The centre lug of this strip is earthy and supports the incoming earth lead as well as the electrostatic shield lead, and the lead from the centre tap of the centre tapping resistor.

The remaining ends of the power diodes and the appropriate transformer and choke leads are anchored to the lugs on the electrolytics, which are upright types and one of which must be insulated from the chassis.

Toward the middle of the front edge of the chassis is a 5-lug strip used to support the tone control wiring and components which swing between the strip and the potentiometer lugs. The topmost lugs support the 68K resistors in the bass network and the corresponding leads going to the coupling capacitors as well as the appropriate ends of the 560 pf capacitors from the treble network.

The next lug is used as an earth point in the single point system, the actual earthy lug, which is the following one down, not being used. The lowest lug is a HT point and is a junction for the filter choke and the second filter capacitor.

DUAL CAPACITOR

The second filter capacitor is a dual unit, housing the second filter and the decoupling capacitors. The decoupling resistor, which is made up of two one watt units, swings between the lugs of this capacitor.

To the right and directly above the 12AU7 socket is a 5-lug strip which supports the coupling capacitors, and the leads to the tone control circuit. One of the lugs is also used as an earth point in the single point system.

The plate loads of the 12AU7 are suspended by their pigtails between the respective socket pins and the decoupling section of the dual electrolytic. Likewise, the cathode bias resistors and their bypasses are suspended between the socket pins and a lug on the 8-lug strip below the 12AU7 socket, which is another point in the single point earthing system.

The cathode circuit of the triode section of the 6BM8 also returns to this earth point and a run is made from the lug to a final earth point at the input socket.

Two of the lugs on this strip also act as junctions for the bias resistors, the 150 ohm resistors and the leads from the feedback network. The final lug on the extreme right is a non-decoupled HT point, to which is connected one side of the primary of the right hand output transformer.

ANCHOR POINTS

Two 2-lug strips directly below each of the 6BM8 sockets act as anchor points for the output grid circuits, supporting the grid leaks, grid stoppers and the coupling capacitors from the preceding stages.

The bias resistors and bypasses of the output stage swing between the socket pin and earth points on the input sockets.

Voice coil output is taken to two four pin sockets on the rear lip of the chassis. The feedback components may be supported between the lugs on these sockets.

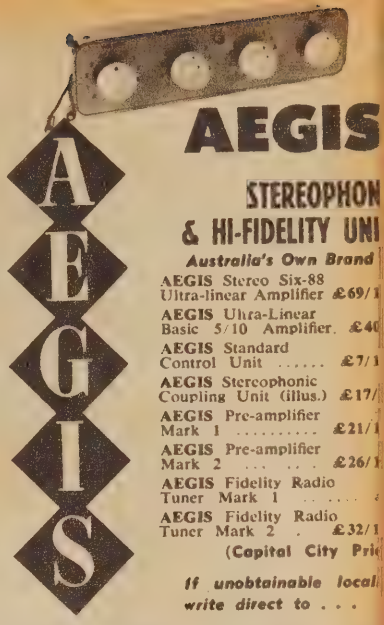
To enable you to assess the performance of your amplifier against the original, here are a few voltage and current readings. The figures are approximate, a few volts one way or the other being of no consequence.

Measuring from the output plate to earth you may expect about 266 volts; from the screen to earth about 220 volts; total HT measured at the second filter capacitor about 276 volts; total current drain is about 78 mA.

BIAS VOLTAGES

At the 6BM8 pentode cathode you may expect about 16 volts bias; at the 6BM8 triode cathodes, 1 volt, and at each of the twin triode cathodes about 2.8 volts.

The foregoing should provide all the information necessary to enable anyone with a little constructional experience to produce a unit virtually identical with the one built in our workshop. And not only will it look the part, but, driven from any reasonably good crystal pickup and fed into a pair of modern speakers, it should sound really fine.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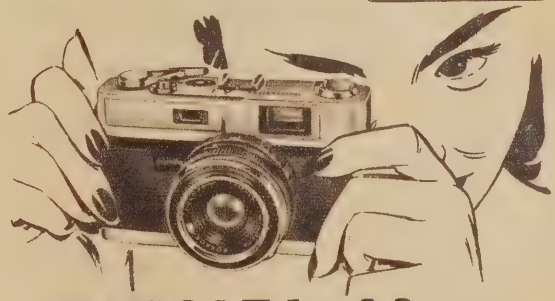

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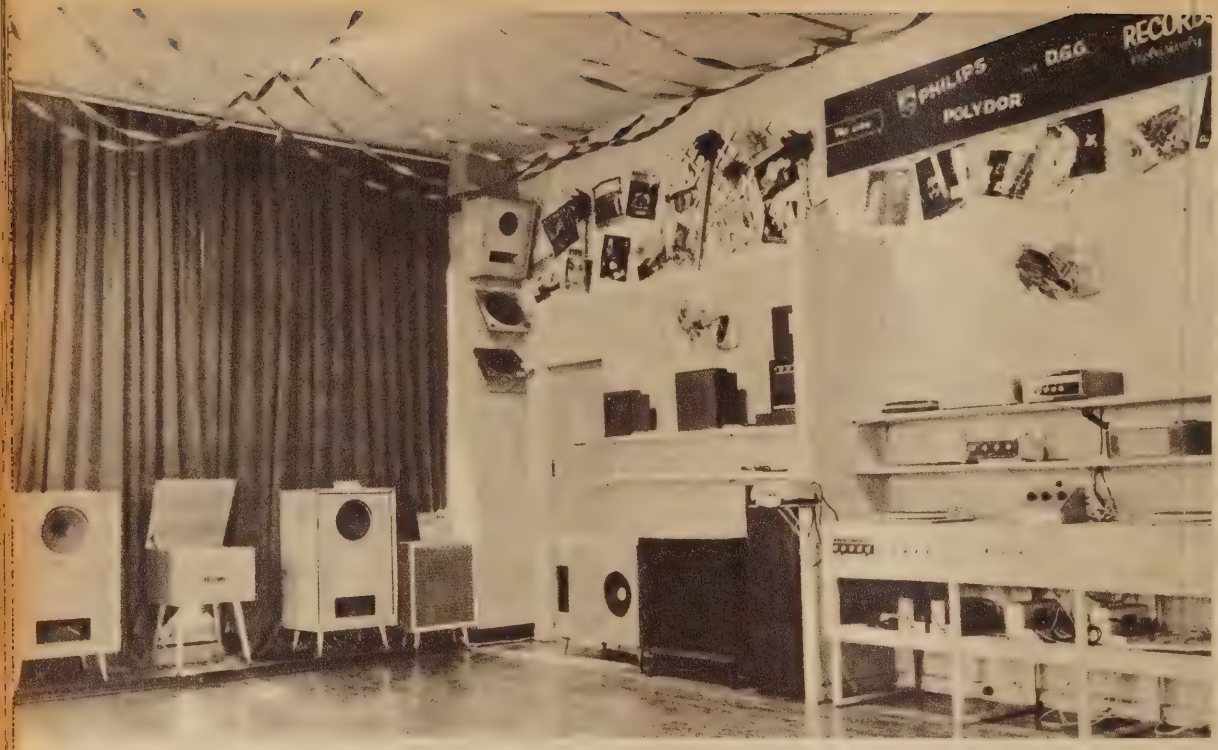

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PHOTOGRAPHING TELEVISION DX

As indicated by these pictures, there is a small but persistent interest, locally and overseas in television DX—or long distance reception. The following *article by G. E. Simkin, contains an interseting suggestion for photographing "noisy" images.

ONE of the most satisfying ways to log TV dx is to capture the test pattern or ID slide on film. However, most articles dealing with photographing cathode-ray tube images or TV pictures deal with strong, local signals.

The TV dxer is often faced with trying to photograph a TV signal that is barely readable or very unstable to begin with. Both of these situations call for unsual photographic procedures for the dxer to get optimum results.

BASIC PRINCIPLES

First, let's review some of the principles of getting a picture from your TV screen. Since the TV picture is a light source, your set should be in a darkened room—dark enough so the screen will photograph black when the TV is off. This is the blackest black you can get in the final picture. Of course, flash must not be used.

One complete frame of a TV picture takes 1/30 second, and a shorter exposure will not get a full frame. A slightly longer exposure generally does no harm so the standard 1/25 second is good. (In countries using a 25-frame-per-second system, the 1/25-second exposure is ideal.)

The light from the screen is usually low, and for this reason a fast film and lens are desirable. The actual combination varies with the condition of the TV set, but f2.8 with tri-X film is a good starting point.

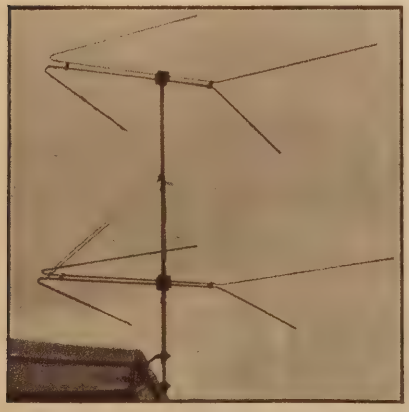
(Much appears to depend on the brightness of the image, since we have secured very successful pictures using FP3, ASA 80, at f3.5, and 1/25 second. Particularly when using 35mm cameras, the finer grain film would offer definite advantages, while not all larger cameras can boast an f2.8 lens. Editor, "R., TV and H.")

A large screen is easier to get in focus; but if you can focus the camera on the screen and have the screen almost fill the negative, there will be little difference between a 7in and a 27in set.

What about unstable DX pictures? They may be unstable because of interference, rapid fading, ghosts, or combi tions of these. Under these conditio many TV sets synchronise differently each field (half-frame), adding to confusion.

In such circumstances, a photogra of a single field will give the clear picture. In other words, take your p ture at 1/60 (or 1/50) second. T gives only every other line, but if int lace is not good you can get a clea picture from a single field.

** from "Radio-Electronics"*



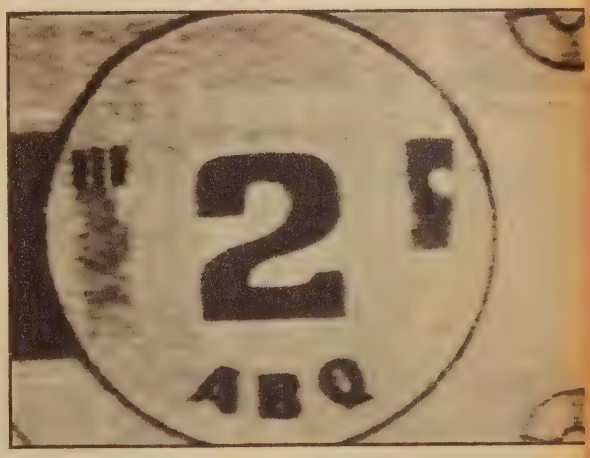
The aerial used by Mr Haydon—a stacked double-V beam.

This photograph comes from Mr Harry Rose, of Auckland, N.Z. It is from ABN, Channel 2, Sydney, taken at 8.10 p.m. (N.Z. time), during January. During the period 5 to 8 p.m., the picture and sound were sometimes stronger than from the local experimental station. This was the sixth occasion on which ABN had been received.

☆

Mr A. E. Haydon, of Orakei, Auckland, N.Z., sends in this picture received from TCN, Channel 9, Sydney. He says that Channels 2, 7 and 9 were received on January 27, Channel 9 being available till closing at 1.30 a.m. N.Z. time. The receiver was essentially the RT & H 110-degree circuitry, with 17-inch tube (Exposure 3 secs., hand held, f2.8, outdoor type Ferranicolor).

☆



Mr G. F. Palmer, of Williamstown, Victoria, records this picture from Channel 2, ABQ, Brisbane, on Christmas morning, 1959, between 10.30 and 11.30 a.m. Melbourne's ABV, on the same channel, was not transmitting at the time.

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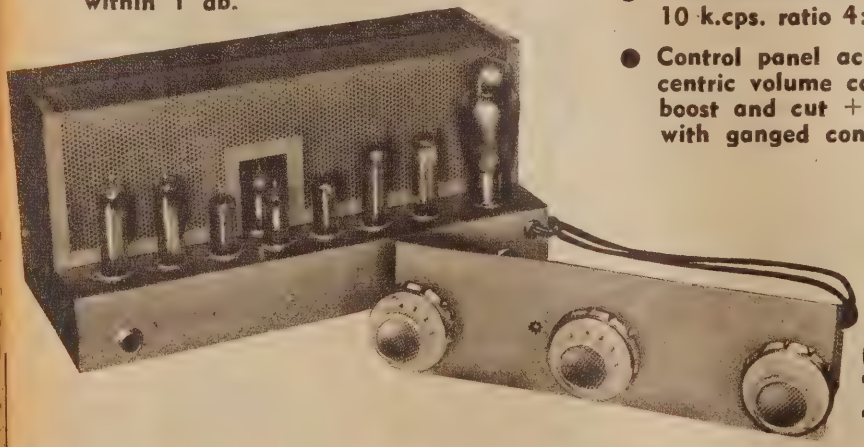

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The lens need not be opened any wider, as each line is just as bright as before. This method also applies to photographing a rapidly moving scene.

A more interesting case is where the signal is steady but weak, perhaps so weak that it is not readable. If synchronising is stable and the picture is the same for a second or more, a considerable photographic improvement is possible.

Snow is really just random noise and, being random, it rarely occurs twice at the same spot. With a fixed picture, the picture details always fall at the same place.

If the total light from each point is added, there could be about as much white as black at each point from the snow, while the white and black of the picture remain steady, causing increased detail to show.

This can be done photographically. Adjust the set's hold controls for maximum stability and turn the intensity down until the snow just vanishes in the blackest portion of the picture.

Set the contrast just high enough to get good whites, but not so high that the white portions become defocused. Then increase the camera exposure to a second or so and stop down to around f16 to keep the longer exposure from over-exposing the film. Almost all ID slides are shown for some time, and it is possible that this could be the sole identifying means for some TV dx.

One word of warning: cameras with focal-plane shutters may give peculiar results, especially at fast shutter speeds. These can be reduced if the camera is set so the focal-plane shutter operates from bottom to top. The shutter then tends to follow the scanning on the screen, as the image in the camera is niverted.

MULTIPLE NEGATIVES

If you do your own photographic printing, one other method can improve your final print. Take several pictures of the same test pattern or ID slide with the camera in precisely the same place each time.

Either underexpose them or underdevelop them, and then carefully stack the negatives so the picture elements all coincide and use the stack as a single negative. Although not as easy as the single long exposure, the principle is the same.

It can also be done with rapidly fading or jittery pictures to give some improvement.

So the next time you are trying to read that very snowy or jittery test pattern or ID slide, try to ID it with your camera. You may be surprised by the results!

ELECTRONIC FRIDGE

The latest field to be entered by electronics is refrigeration, and we may yet see a completely electronic refrigerator with the same or higher efficiency as the present mechanical type.

Such devices have now reached the stage where two American firms, Philco and Westinghouse, have made applications for patents on electronic units using the Peltier effect. This causes cooling when current passes through a junction of dissimilar materials, in this case germanium, indium, and antimony.

However, neither company is prepared to set a date for the first all-electronic, no-moving-parts refrigerator.

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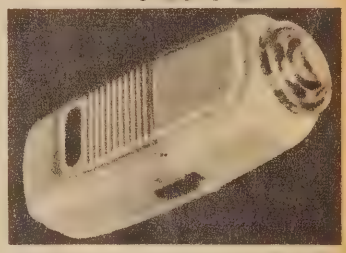

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BONDED SHIELD PICTURE TUBES

Latest trend in TV design in America and in Australia is to the use of so-called "23-inch" picture tubes. This article from the Sylvania Company (U.S.A.) explains the development of a particulary type of 23-inch tube involving a bonded shield or face-plate.

WITHIN the past two years consumers have witnessed the fulfilment of eir request for a reduction in both the ze and weight of television receivers.

This improvement was made possible the development of the 110-degree cture tube with its shorter neck, haller cone and lighter weight per unit screen area.

Sylvania's TPF (Tri-Potential Focus) ectron gun contributed to a further duction in cabinet depth by shortening e picture tube neck length still more.

[Editor's note: To the best of our owledge, we understand that this very ort "high-efficiency" gun is not curntly used in locally manufactured bes. However, it is to be featured in least some of the new 23-inch tubes rrently in pilot production.]

The improvements in television revers desired by consumers, however, re not limited to compactness and rtability. In addition, they sought: (1) screen that would not "fog up," or at st one that could be easily cleaned; Reduced reflection and glare; (3) more rectangular screen; (4) A tter screen to reduce distortion; and A brighter picture with higher const.

In answer, Sylvania offers the Bonded eld Picture Tube—an entirely new sign.

The Bonded Shield design features an egral, wrap-around safety panel, thus minating the traditional separate plas- or glass safety panel. Figure 1 shows new panel separately, and in place form the Bonded Shield tube.

The new panel, which is made of ss, is manufactured with the same cision as the faceplate and matches faceplate in contour.

Figure 2 shows the sandwich-like conuction of the face of a completed nded Shield tube. The panel is permnently and strongly bonded to the basic picture tube assembly with a newly developed epoxy laminate.

The epoxy laminate has the same index-of-refraction as the glass used for the faceplate and wrap-around panel. The bond that is formed is therefore optically perfect, as well as physically strong.

A more rectangular screen with increased viewing area is another feature inherent in the new design. The difference between the Bonded Shield design and a standard 21-inch picture tube in this respect is vividly shown in Figure 4.

The increase in viewing area totals 20 square inches. The increase in diagonal measurement amounts to approximately two inches, hence the figure "23-inch."

As a result of the high voltages employed, television receivers are notorious dirt collectors. With a separately mounted safety panel, dust particles and mois-

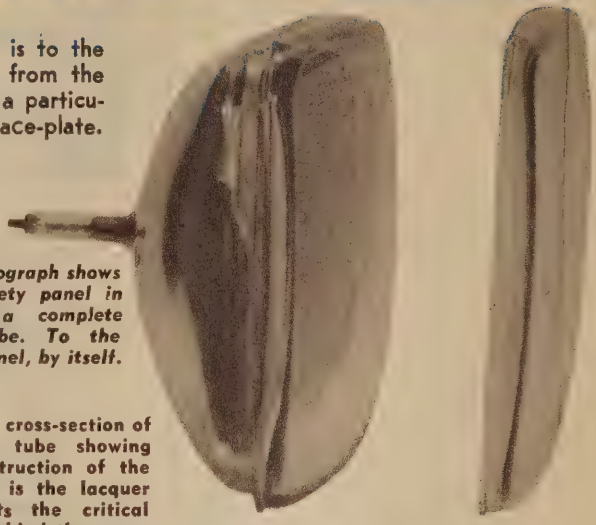
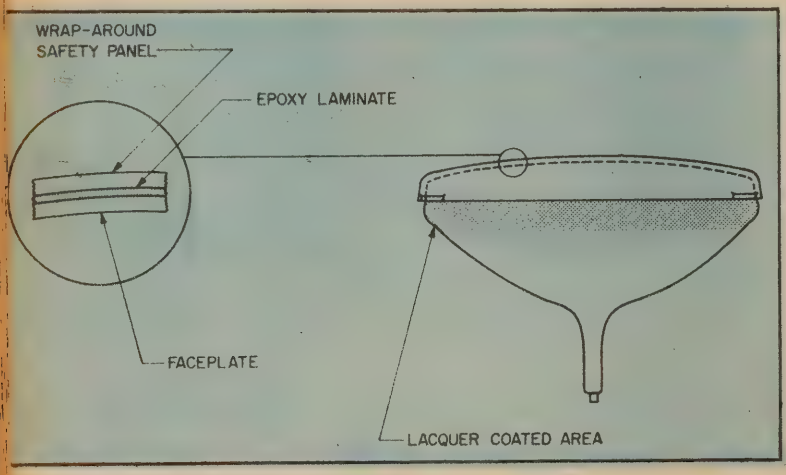


Figure 1: This photograph shows a wrap-around safety panel in place, to form a complete Bonded Shield tube. To the right is a safety panel, by itself.

Figure 2 (below): A cross-section of the bonded-shield tube showing the sandwich construction of the face. Also shown is the lacquer band that protects the critical area of the tube behind the wrap-around panel.



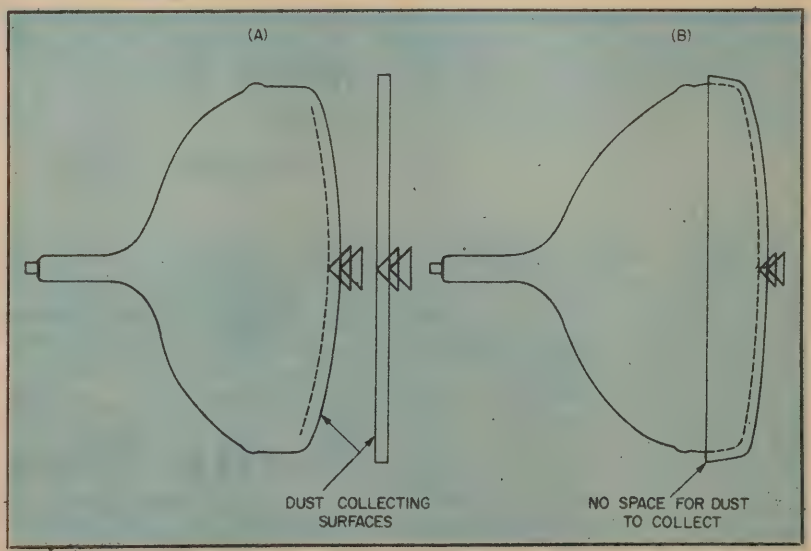


Figure 3: (A) separate safety panel results in four possible reflecting surfaces and an area where fogging can occur. (B) Bonded shield concept eliminates two reflecting surfaces and the dust collecting area.

ture, precipitated from the air, accumulate on the picture tube faceplate and inner surface of the safety panel, Figure 3A.

The film that is formed reduces picture brightness, contrast and resolution. While cleaning the two surfaces involved will restore picture quality, this seemingly simple chore frequently requires the talents of an experienced serviceman.

Bonding the safety panel directly to the faceplate eliminates this problem area completely. The new wrap-around panel can be wiped free of normally accumulatd dust by the housewife without fear of scratching or otherwise destroying optical quality.

Reflection is another source of picture degradation and general viewing discomfort. With a separate safety panel, there are four surfaces that reflect light back to the viewer.

As shown in Figure 3A, they are the front and back of the safety panel and the front and back of the faceplate. Bonding the safety panel to the face of the picture tube with an epoxy laminate cuts the number of reflecting surfaces in half.

BRIGHTNESS, CONTRAST

In effect, this improvement increases both brightness and contrast, and reduces glare.

Being accustomed to rectangular windows, mirrors, etc., the consumer has a natural preference for a rectangular television screen. As shown in Figure 4B, the Bonded Shield tube is considerably improved in this respect.

The 20-square-inch larger screen of the Bonded Shield tube represents an increase in the viewing field, not just the size of the screen.

When the rounder screen of a standard picture tube is fully scanned horizontally and vertically, the corners are being over-scanned. The amount of overscan is shown in Figure 4A by the shaded area.

The electrons represented by these shaded areas strike the walls of the bulb where they are reflected to the screen. The effect is reduced picture contrast, particularly in the corners of the screen.

The straighter sides and square corners of the Bonded Shield design appreciably reduce the amount of corner overscan, Figure 4B, and measurably improve picture contrast.

The Bonded Shield tube also features a flatter screen to reduce distortion at wide viewing angles. The improvement that can be expected is clearly illustrated by the scale comparison of horizontal screen curvatures shown in Figure 5.

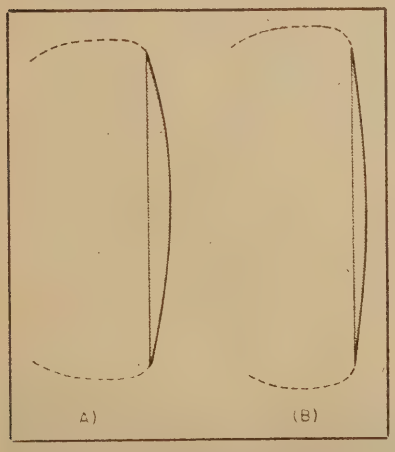


Figure 5: Comparison of screen curvatures. The flatter face improves viewing from oblique angles.

Complete implosion protection is another welcome feature of the Bonded Shield tube, and is especially important to the serviceman who must handle this component daily in his work.

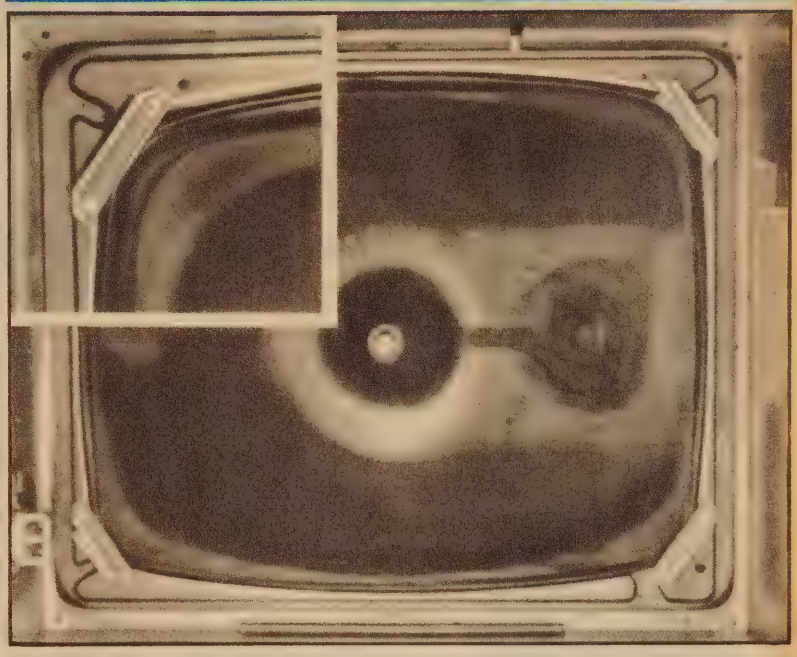
Abrasion and moisture are two factors that measurably reduce the strength of glass. The former is most likely to be introduced during handling while the latter is a function of environment.

In previous bulb designs, the influence of these two factors is minimised by thick glass walls and convex curves. With the Bonded Shield design, the wrap-around safety panel, epoxy laminate and lacquer coating, Figure 2, completely protect critical areas of the bulb.

Extensive testing by Sylvania and the Underwriters' Laboratories indicate that when a Bonded Shield tube is broken, there is no violent implosion or flying glass.

While the Bonded Shield tube is in-

NEW TUBE MOUNTED IN CABINET



This photograph shows the simplified mounting arrangement, the tube being held by four simple corner clamps.

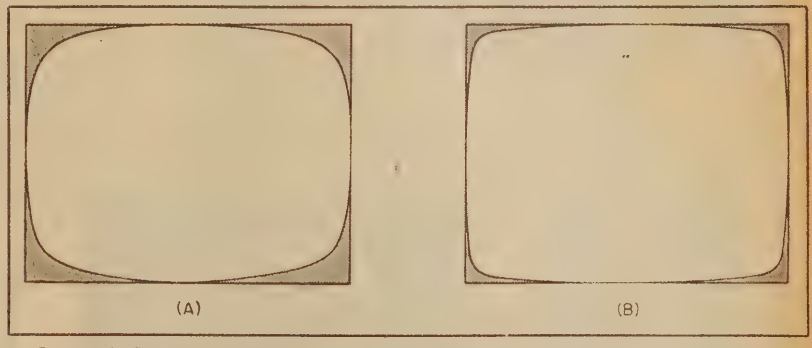


Figure 4: Scanning beam moves into the shaded areas (A) for a conventional tube and causes needless "spill" of light to remainder of screen. (B) shows the reduction of these areas with the new, more rectangular screen.

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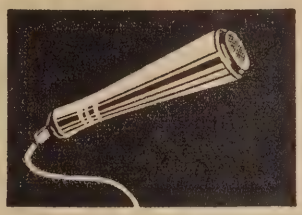

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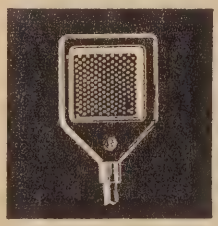

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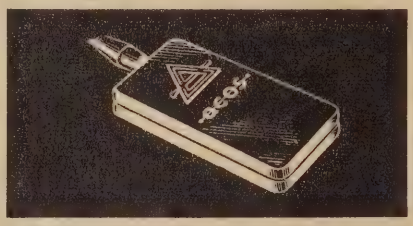

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herently much stronger than previous picture tube designs, it is still made of glass and should be treated accordingly.

The critical area of the bulb, beginning at the back edge of the wrap-around safety panel and extending beyond the seal, Figure 2, although protected by a coating of lacquer against accidental scratching, should still be treated with care.

Every effort should be made to avoid contacting this section of the bulb, particularly with metal objects.

Here is a feature that should please the serviceman. The safety panel is equipped with four glass mounting lugs. Utilisation of the lugs results in the typical, exceptionally simple tube clamping arrangement shown in Figure 6.

Four small strap-clamps straddle the lugs and are bolted to the escutcheon. A soft pad between the clamps and lugs evenly distributes the pressure applied by the clamps.

The glass lugs, incidentally, are plenty strong enough to do their intended job. Receiver drop-tests have repeatedly shown that the mounting hardware will tear loose from wood cabinets before the lugs will break.

CONVERTING SETS

As consumers become aware of the definite improvements in picture quality that are realised with Bonded Shield picture tubes, some will wonder if their present sets can be converted.

From the preceding illustrations, it is apparent that conversion, although not impossible, is impracticable in most cases.

Both the escutcheon and mask would have to be extensively remodelled to accommodate the squarer, flatter face of the Bonded Shield tube. Further, the tube clamping arrangement would probably need extensive revision.

While there is little likelihood that anyone would want to substitute an earlier design for a Bonded Shield type, a word of caution is justified.

In no circumstance should a picture tube designed for use with a separate safety panel be placed in a receiver that does not have such a panel.

The first Bonded Shield picture tube being produced in volume is Sylvania's type 23CP4. Briefly, this is a non-ion trap, electrostatically focused, 110 degree deflection tube. Other features include an Aluminised Screen and a Grey Filter-Glass face-plate.

A Bonded Screen tube employing the Sylvania TPF electron gun is also available. Numbered 23DP4, this type has a 1½-inch shorter neck than the 23CP4.

In conclusion, the new-concept Bonded Shield picture tube is a major advance that opens the door to new cabinet styles combined with added viewing safety and pleasure.

(Editor's note: Local tube manufacturers appear to be keeping an open mind on the subject of bonded face-plates.

There seems little doubt that 23-inch and 19-inch tubes, with more rectangular screens, will ultimately displace the current 21 and 17-inch types. However, they are more cautious about bonded screens.

While these are already being manufactured locally, set-makers may be inclined to favour established techniques with plain tubes and safety glasses.

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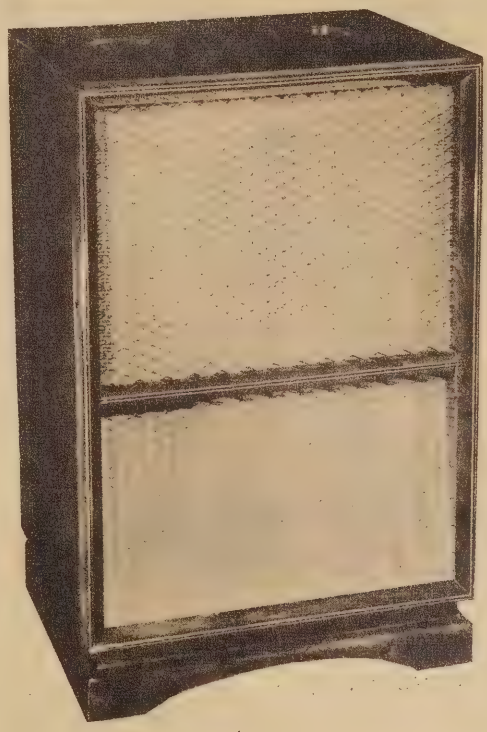

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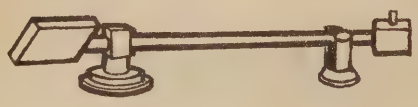

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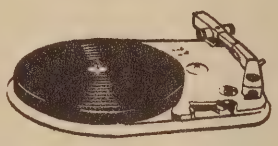

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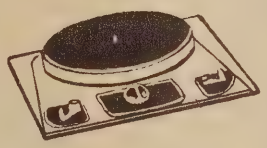

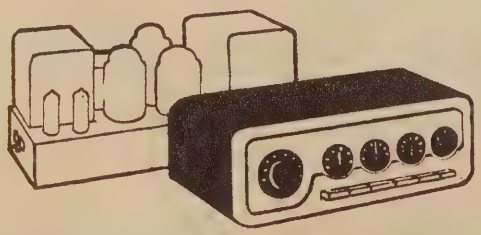

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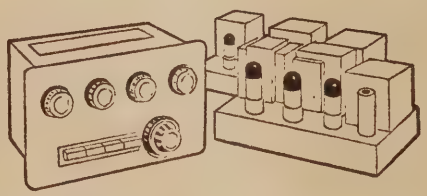

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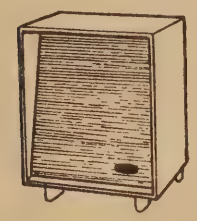

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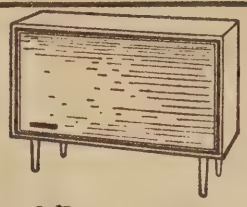

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Audiom 80

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Complete Three-unit High-Fidelity System. Overall frequency range: 30 c/s.-16,000 c/s. Bass Unit: Audiom 80 15" single-cone unit (30 c/s.-750 c/s.). Mid Range: Midax 400 pressure-driven horn unit (750 c/s.-5,000 c/s.). High-Frequency: Trebax pressure-driven horn unit (5,000 c/s.-16,000 c/s.). Capacity: 25 watts. Dimensions: 33" x 22" x 20½".

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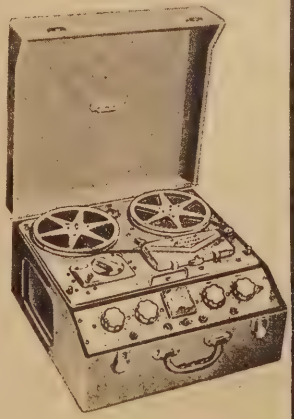

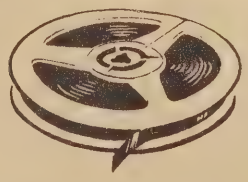

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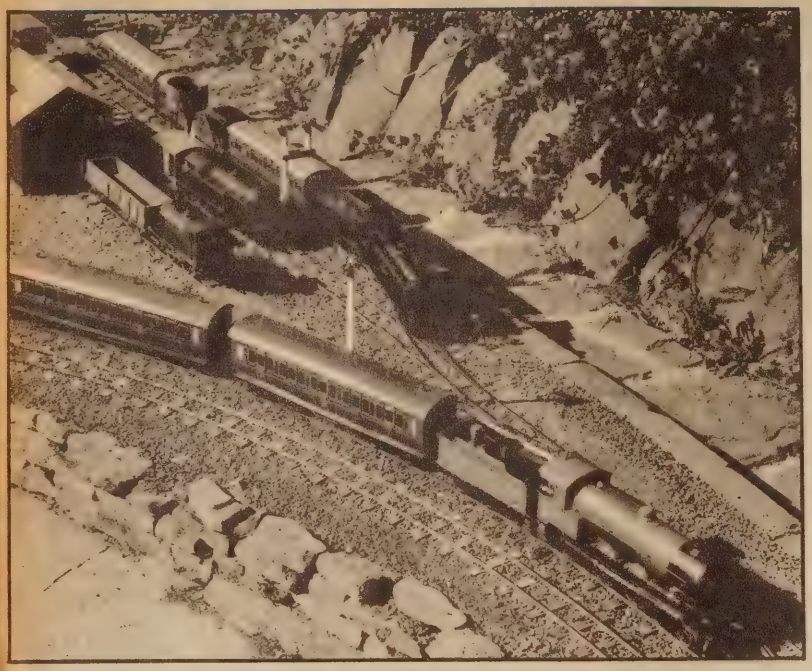


Model trains, accurate in scale of detail, still appear to be in the "dark ages" of electronics.

Carrier Control For Model Trains

The number of people who build and operate model trains as a hobby seems to be as great today as it was a decade ago. Although the accuracy, availability, and cheapness of the trains themselves have been greatly improved over the years, few important strides in the field of model train electronics have taken place.

THE electrical system chosen by most scale-model train manufacturers and builders is a DC type, utilising permanent-magnet type motors in the locomotives. This system has the advantage of easy trackside reversing, but it also has a number of disadvantages, in common with most other systems.

One major disadvantage is slow-speed control. The usual method of placing a variable resistor in series with the train and supply will slow down the locomotive and train, but also cuts the available power greatly. This means that the extra load imposed by track curves or small "hills" slows down the train to a point where it may easily stop. It may further mean that a realistically slow start for a loaded train is impossible.

This problem can be eased somewhat by using a supply transformer having an exposed secondary winding over which moves a sliding brush attached to the controller handle, thus supplying a variable AC voltage to the rectifier. This greatly improves the regulation, but means that a separate transformer-rectifier combination is needed for each train to be operated.

The regulation problem is still not completely solved, however, as the inherent regulation of the transformer-rectifier combination is rather poor, unless it is being very under-run. This means that, to improve the regulation of the supply when using trains drawing say two amps, one should buy a unit capable of supplying six amps.

Another snag appears when the modeller wants to run more than one train at once, with individual control of each train. This can be solved, to a point, by dividing the track into sections, or "blocks," and having each block controlled by a control knob. If one is running even three or four trains on a layout consisting of about five "blocks," one soon discovers that a very nimble brain and about five hands are required.

The problem of voltage drop in the rails is also experienced in layouts of any size. Luckily this can be overcome by using soldered rail-to-rail connections, and making more than one connection from the supply to the track where a large length is involved, the connections being in heavy gauge wire, to have a low resistance.

The regulation problem has been given a lot of thought by quite a few people and, basically, the suggestions seem to fall into two groups (1) that involving a self-regulating saturated transformer, and (2) that involving an electronically regulated supply, possibly using transistors.

While such a supply would undoubtedly solve the regulation problem, it would place the individual control position no further ahead.

NEW APPROACH

With this in mind, the writer, in association with Mr K. N. Stanton (University of New South Wales), came up with, as far as we are concerned, a new and novel approach to this problem.

The idea basically is to use a carrier-control system, similar to that used in remote control of model planes and boats. The carrier, at a frequency of about 50 kilocycles, is applied to the rails along with a fixed DC supply voltage from an accumulator or other power supply.

The train contains a transistorised receiver, which detects the carrier and uses a power transistor to control the speed of the motor in the locomotive. The strength of the carrier is varied by the controller knob and the receiver regulates the speed of the train according to the carrier strength present.

Individual control of a number of trains is thus possible, with each train operated by a different frequency. Another feature is the inclusion of negative feedback, allowing the effective impedance of the supply to be greatly improved as far as the motor is concerned. This means that quite low speed operation is easily obtainable and power is not sacrificed for realism.

EXPLAIN DIFFICULTIES

The system is not without disadvantages, however, so before too much is said, it might be well to explain the difficulties.

The first is that the transistor must be supplied with voltage of the correct polarity to ensure correct operation, and this pre-determines the polarity of the voltage to be applied to the rails.

This poses problems about reversing, and, while it is not impossible to include reversing facilities in the carrier-

By Jamieson Rowe

control system, the space limitation in narrow-gauge trains prohibits elaborate relays or circuitry. However, there remains one method at least for providing the reversing feature in a simple manner, and more about this method is given later in the article.

This space limitation constitutes the second drawback. Even though every effort was made to produce a miniature receiver suitable for inclusion in a standard "OO" or "HO" gauge locomotive body, the final design, while quite small in size, is too large for the standard "tank" locomotive body.

It is however, suitable for building into a tender, or perhaps a small covered van, as was used in one of the prototype models.

FOOD FOR THOUGHT

The design presented in this article is therefore not presented as a "cure-all" for all model-railroader's problems, but as a contribution to the general situation, and to provide food for thought.

If one values the facility of trackside reversing very highly, i.e., above good slow-speed regulation and ease of individual control, then the simple unit described will not appeal to any great extent, and even the modified version introduced at the end of the article will not "fill the bill."

This is not to say that the modified version does not provide means for trackside reversing, however. What it does do is incorporate the reversing feature in a way which removes the individual control feature and the good regulation, so that the old rheostat control system and block control wiring must be retained. In other words, the individual control and good regulation then apply only to the forward direction of travel, the control of the train in the reverse direction being along normal lines.

The desirable qualities of a model train system seem to be the subject of much debate, and opinions differ markedly.

However, for those readers who do feel that this method of train control is sufficiently promising to warrant building a unit of this type, here are the details of the actual system constructed in our laboratory.

CONTROL UNIT

The Control Unit or Transmitter contains two Hartley oscillators, tuned to frequencies of 40 and 60 kc/s.

These oscillators are supplied by a conventional full-wave choke-input power supply using a 6X4 rectifier valve connected to a 225-volt a side 50-mA power transformer.

The oscillator valves used are 6AQ5s, normal output types. The oscillator circuitry is designed around coils used for the bias oscillator in tape recorder amplifiers and, in fact, the circuit is very similar to that supplied with the coil for this purpose. The coils used are marketed by R. W. Steane (Q-PLUS) and are designated type OME.

The Receiver is 3½ x 1¼ x 1 inches, small enough to fit into a small van or tender.

CONVENTIONAL CONTROL SYSTEM

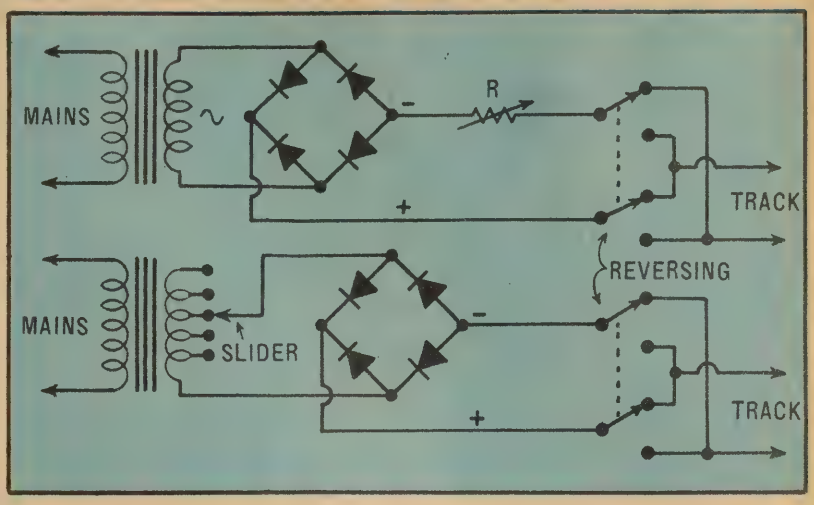


Fig. 1. Showing the two basic control systems used at the present.

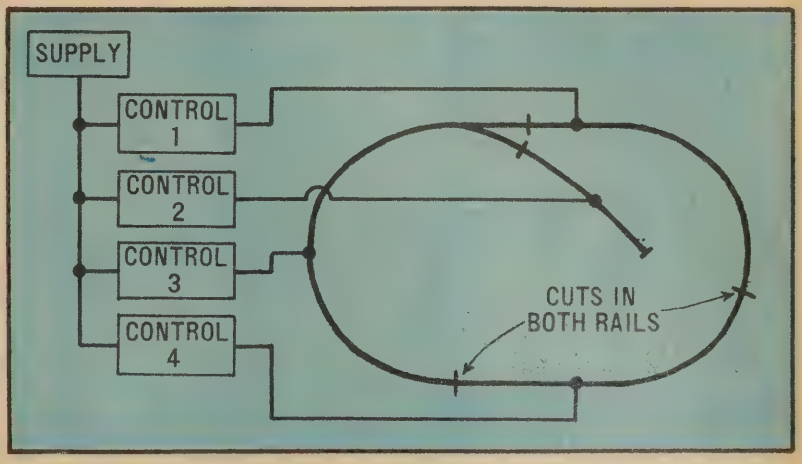
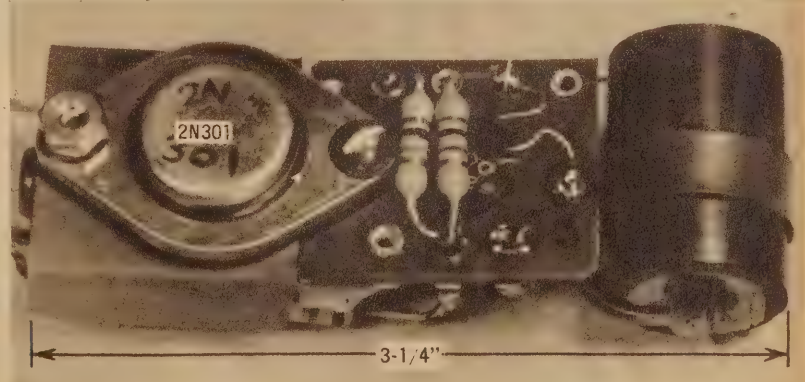


Fig. 2. Showing the method of individual control of trains by dividing the track into sections or "blocks."

The resonating capacitor across the oscillator coils needs to be different in each case, to provide different carrier frequencies. Fine adjustment of frequency tuning is done using the slugs provided in the coils. Adjustment of frequency is done at the transmitting end of the system, as a variable device on the receivers would increase the bulk, and hence reduce the versatility of the system.

The outputs of the oscillators are controlled by 10 ohm potentiometers, and fed to the track via an electrolytic capacitor for DC blocking.

A point to note here is that the DC supply used may, perchance, be of quite low impedance at the carrier frequencies



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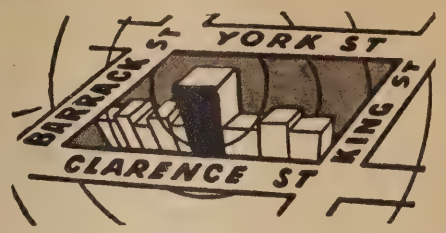

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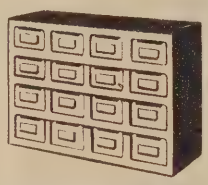

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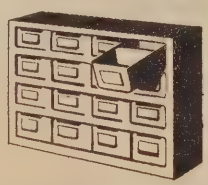

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used and would thus shunt all the RF from the track.

To remedy this, a choke having a very low DC resistance may be placed in series with the DC supply. The low impedance secondary of a speaker transformer is very suitable here and may be included in the unit if found necessary.

The transmitter was built up on a small U-shaped chassis of aluminium, suitable for mounting behind a control panel. The two speed-control knobs were left with long spindles, so that quite thick panels could be used without difficulty. The power supply components were grouped in the centre of the chassis separating the two oscillators, which were arranged symmetrically on the chassis.

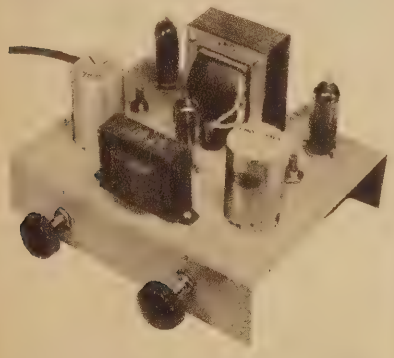
FAIRLY SIMPLE

Wiring of the transmitter is not very critical, and no trouble should be experienced in reproducing it. Grid leads should be kept as short as possible, and the placement of leads around the oscillator adjustment pots should be noted. The mains supply cord is introduced through a rubber grommet and knotted, to prevent strain on the soldered connections at the tagstrip.

The receiver consists of a series-tuned circuit which is used to extract the carrier from the track, a germanium diode detector, and a two-stage DC amplifier.

The output stage of this amplifier is an emitter-follower, providing a low output impedance to match the locomotive motor, which constitutes the load. Negative feedback is included in the amplifier, further to lower the output impedance.

Signal voltage produced across the tuning coil at resonance is detected by the OA5 germanium diode, which is tapped down the coil to reduce the load-



This is the Transmitter, suitable for mounting behind a control panel.

ing effect of the relatively low impedance detector load circuit.

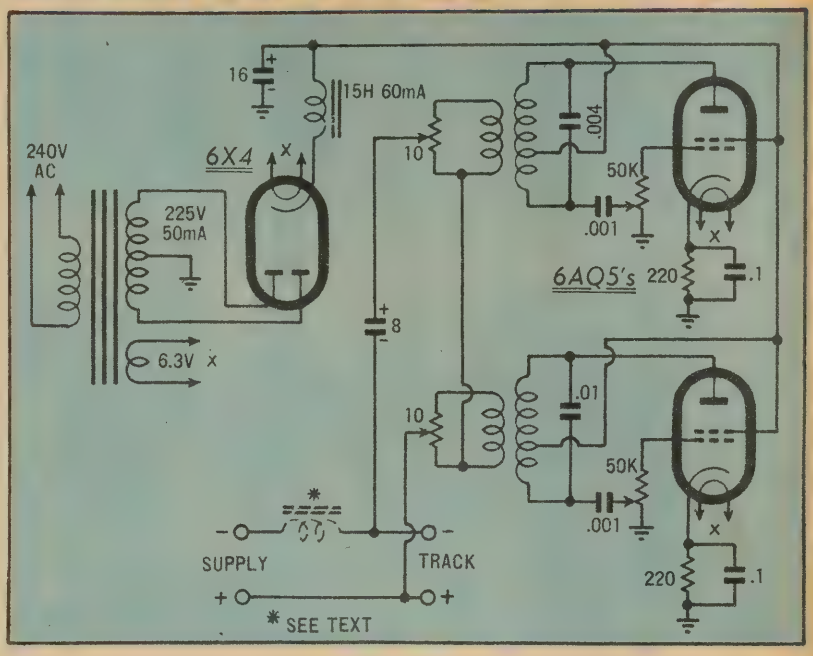
The tap is one-third of the way down the coil. If the coil were wired in circuit so that the tap was two-thirds of the way down (that is only one third of the coil is loaded) the selectivity of the tuned circuit would be better, but we should get less RF output.

The present connection seems to be a good compromise.

The series tuning capacitor marked "C" is varied in value to tune the receiver. The values used in the prototype models are 0.03 mfd and 0.068 mfd, but other values will have to be determined if different frequencies are used.

DC output produced by the detector diode is filtered by the 0.003 mfd condenser and applied to the base-emitter circuit of the OC72 transistor.

CIRCUIT OF TWIN "TRANSMITTER"



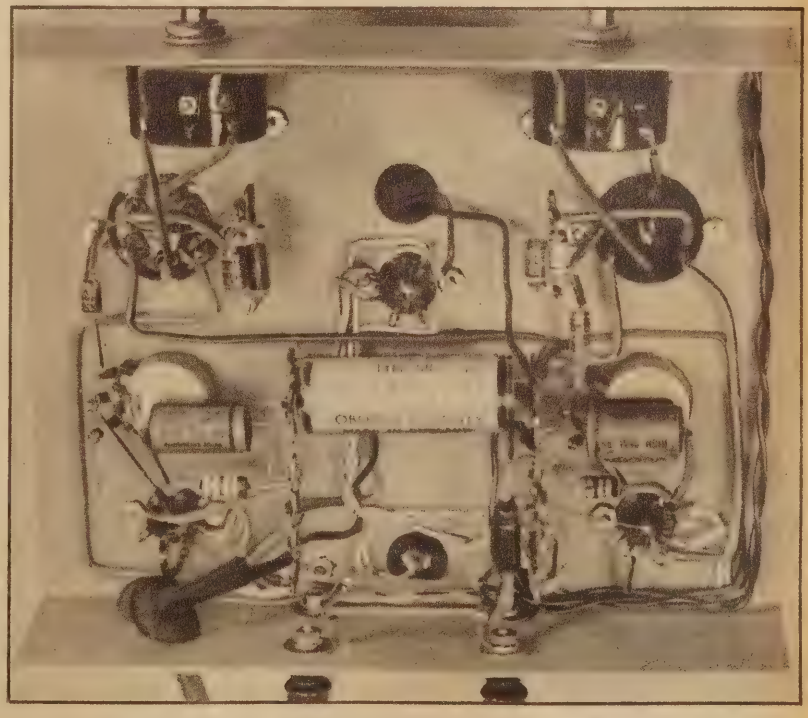
The Transmitter is quite straightforward, and should present no problems to the constructor.

Thus the positive voltage produced by the detector circuit tends to make the base of the OC72 more positive. This reduces the base current of the transistor, and so the normally flowing collector current is reduced.

When this happens, the voltage drop across the 470 ohm load resistor becomes less, making the base of the 2N301 power transistor more negative.

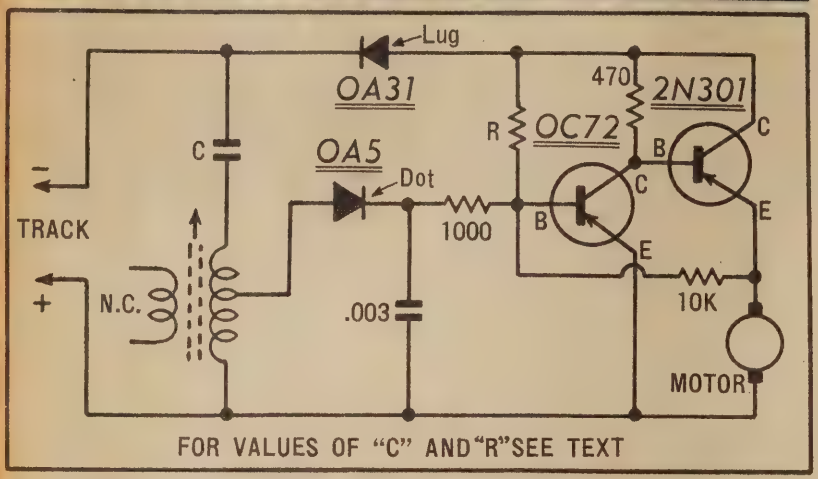
This in turn increases the base-emitter current of the 2N301, which causes the collector-emitter current to rise. This current passes through the motor, causing it to speed up.

A portion of the motor voltage is fed back to the base of the first transistor in such a way that, if the motor voltage drops due to slowing down under load, for instance, the circuit delivers the necessary current to restore the motor voltage to its former value.

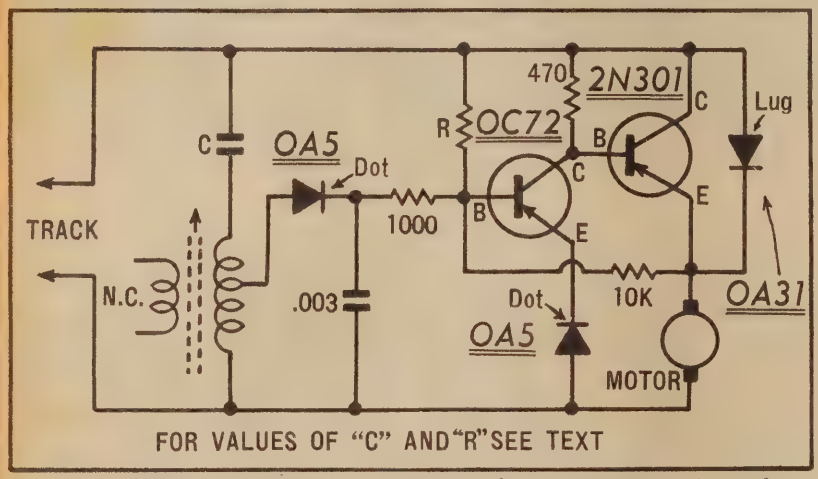


The wiring of the Transmitter is visible in this photograph, showing the symmetrical arrangement of the components.

CIRCUIT DETAILS OF RECEIVER



This is the simple Receiver, which does not allow easy reversing.



The modified Receiver allows reversing without carrier control in the reverse direction.

In this respect the circuit may be imagined as a comparator, as it automatically adjusts the motor voltage to a level determined by the carrier. This produces very good regulation of motor speed, even at low levels.

The resistor marked "R" which is connected between the base of the OC72 and the negative supply will depend in value on the motor used. It sets the no-carrier current of the OC72, thus adjusting the no-carrier bias on the 2N301 and hence the quiescent motor current.

If a sensitive motor is used, a low initial value of motor current is required, so the value of R should be reduced. Conversely a less sensitive motor necessitates a higher value of R. Typical values range from 22K to 100K.

The remaining point in the circuit to explain is the OA31 diode in the negative supply line. This is included to protect the transistor circuitry if the locomotive is placed on the rails the wrong way around.

If it were not wired in series with the supply, such a mistake would result in the almost certain ruin of the transistors. With the diode in circuit, the train merely refuses to operate in the event of a polarity reversal, as the diode passes current in one direction only.

The receiver is constructed in a rather unconventional way and the photograph should be carefully studied before construction is attempted.

In place of a conventional chassis is a small piece of punched matrix board measuring five holes long by four holes wide. The 2N301 power transistor is fastened to one end of the board with its associated copper heat sink; the tuning coil is clamped to the other end.

TUNING COIL

The heat sink, by the way, should be as large as possible, to dissipate as much heat as possible. The prototype models have a sink bent up out of a piece of copper sheet about 1in by 2in, in a U-shape to conserve space. Two holes are drilled in them to clear the base and emitter pins, and they were bolted to the transistors with 1/8in bolts.

Some explanation is necessary about the tuning coil. The coil used was an adapted version of an "IF Transformer with Reaction," as used in the Four Transistor Superhet receiver. A coil of this type is marketed under the "Jabel" trademark, and is designated by a black spot.

The coil is removed from its can, complete with its ferrite shell, and the plastic base removed, along with the 455 Kc resonating capacitor. This leaves the winding on a small length of former, inside the ferrite shell. Some plastic tubing is slipped over the leads and, if space is a premium, small nicks cut in the ends of the ferrite shell to pass the leads around to the circuit board.

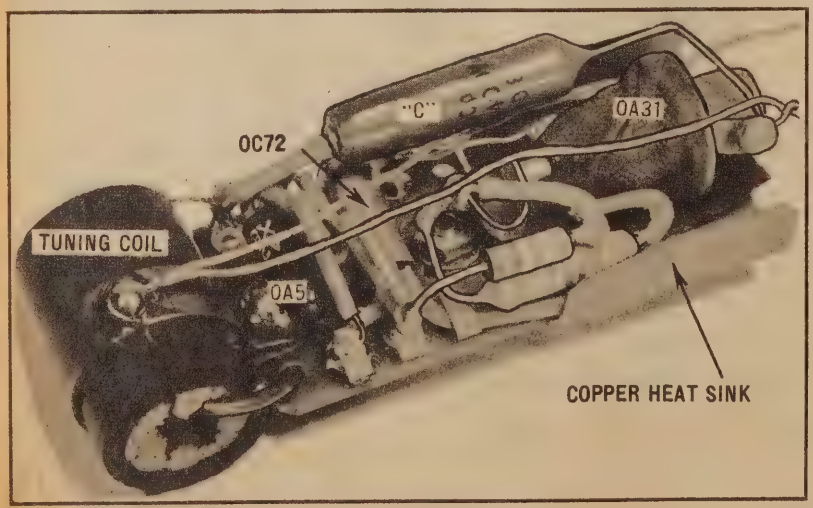
A small strip of copper or other sheet metal bent into a strap clamps the coil assembly to the board, and is used as the positive earth return.

As the photograph shows, the smaller components are mounted on tags attached to the matrix board, the tags being specially designed for the board, and attaching to it in the same manner as eyelets. Care should be taken in punching the tags with a centre punch, as the board is somewhat brittle, and cracks if too much force is used.

Placement of parts in the receiver is not extremely critical, but care should be taken to ensure that shorting will not occur when the unit is placed in the train. The OA31 diode is anchored by its anode lug, which is soldered to a solder lug slipped under the mounting bolt of the power transistor. This lug also provides the collector connection of the transistor.

The OA31 diode should be wrapped

(Continued on Page 95)



The Receiver is arranged compactly around a small piece of matrix composition board.

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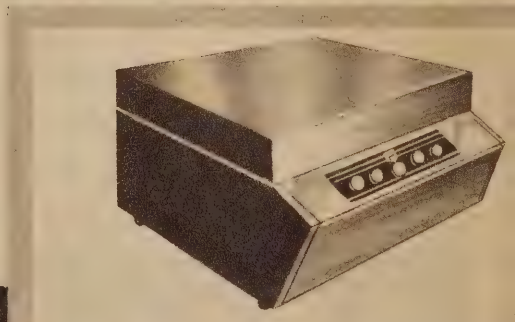

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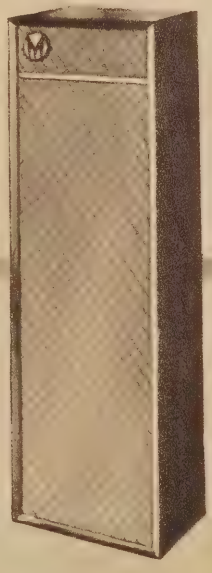

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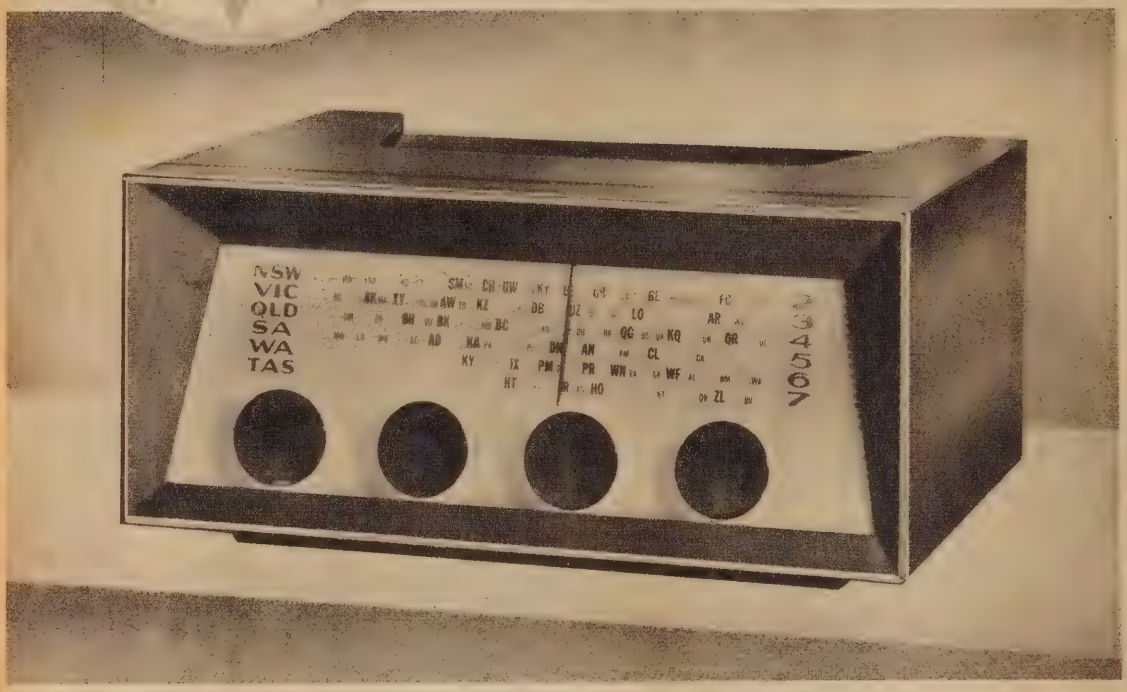

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FROM THE SERVICEMAN WHO TELLS

It seems that, no matter how long one has been in the servicing game, there is always an unusual fault to catch the unwary. At any rate, I was "caught" myself recently when a most elementary fault in a TV set sent me off on a wild goose chase looking for something quite different. Truly, do we live and learn.

THERE is an old saying that one should believe nothing of what one hears and only half of what one sees. That sounds cynical perhaps but, after this episode, I am half inclined to agree with it.

The job started out looking like a perfectly routine assignment. The customer had complained of complete picture failure, and a few preliminary questions had established that there also was no raster, but that the sound channel was normal. Mentally, I ticked off the most likely causes as I checked spare valves and other components before setting out.

EHT SUPPLY?

Purely on the law of averages, I put a failure of the EHT supply at the top of the list; sub-dividing this into failure of the EHT rectifier, line output valve, or line oscillator valve. Next I considered the picture tube and associated circuitry, including the video amplifier. There are many failures around this part of the circuit which can wipe the raster off the screen, particularly where direct coupling is employed.

As it happened, this particular circuit did use direct coupling, so it was quite possible that some abnormality in the video amplifier circuit could result in the picture tube being biased to cut-off. Finally, of course, there was the possibility that the picture tube itself had failed, but I like to keep this one at the bottom of the list.

The customer, on the other hand, had no such inhibitions. He was sure it was the picture tube. To his way of thinking, the fact that the sound was still active, the complete absence of a raster, and the failure of either the brightness or contrast controls to have any effect, was quite sufficient evidence. He couldn't see how it possibly could be anything else.

MANY OTHER THINGS

While easing the set out from the wall and unscrewing the back, I consoled him with the thought that it could most certainly be due to a number of other, and less expensive, causes. Then I set about trying to find one. (I must admit I had sneaked a look at the picture tube heater and made sure it was alight before offering such consolation. It would have been rather pointless with such an obvious fault staring me in the face.)

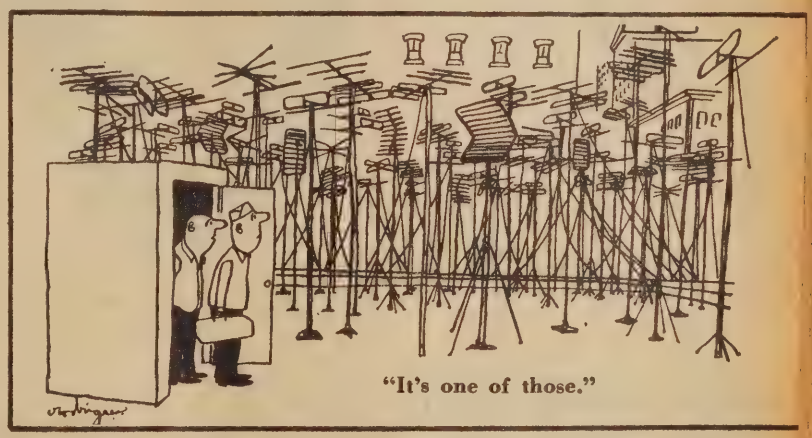
I started with the EHT system. It was easy enough to slip a screwdriver blade through the mesh of the cage and bring it within reach of the EHT rectifier top cap. This produced a nice long healthy spark that left no doubt that plenty of AC was being applied to the rectifier, thus automatically absolving the line output and line oscillator circuits from blame.

Assuming that the rectifier was doing its job there should be plenty of EHT on the final anode of the picture tube. This was confirmed when I brought the EHT lead close to the chassis and once again produced a good fat spark. It looked as though some other operating voltage must be at fault.

First I checked the grid and cathode volts and the relation between them, including a check on the action of the brightness control. All this appeared to be perfectly normal, with a normal range of bias voltage produced by the brightness control action.

This left only the voltages on the intermediate anodes and, when these were checked and found correct, I must confess I was beginning to wonder whether the owner's fears regarding the picture tube might be justified. After all, when a tube is supplied with correct voltages to all its electrodes, but will not produce a raster, the evidence is pretty strong for an internal fault.

However, not wishing to suggest such a situation until I was completely sure, I decided to take the chassis back to the shop. It was the nearest place I could try a substitute tube anyway, as well as providing an opportunity to make quite sure I hadn't overlooked something.



"It's one of those."

(While there are obvious advantages in being able to make quick repairs in the customer's home, it is usually the least desirable place to work when faced with something unusual.)

Back at the shop I fitted one end of an extension cable to the picture tube socket and the other end to a test picture tube of the same type. Then I switched on and waited for a picture to appear. Alas, I waited in vain, for this tube showed no more inclination to produce a raster than the original one.

While gratifying, inasmuch as it suggested the picture tube might be intact after all, it was clear evidence that I had missed out somewhere in my checking. For some reason yet to be explained, and in spite of my checks on operating voltages, the set was not capable of producing a raster on a known good tube. On the face of it, it seemed like a straightout contradiction of facts, but there obviously was a "catch" somewhere and I had to find it.

CHECKED EVERYTHING

Starting with the grid and cathode, I checked everything again, up to the final anode, found all in order as before. The only query concerned the EHT voltage which, so far, I had checked by simply noting the spark it could produce. While there was no doubt about the length and intensity of this spark, there was something about it which made me suspicious. For want of a better term, I could only tell myself that it didn't sound right!

Connecting the high voltage probe to the VTVM, I prepared to make a more accurate measurement, even though I wasn't quite sure what this was likely to reveal. I certainly wasn't prepared for the reading I obtained, which was precisely zero!

On the face of it, it seemed plain silly. There obviously were plenty of volts present, yet the meter wouldn read them. Suddenly, on an impulse, switched the meter function switch fro "DC" to "AC." And there were th missing volts.

Now, of course, the solution to th mystery was horribly obvious. What had imagined was normal EHT volta was not DC at all, but raw AC 15Kc. Little wonder the tube refus to work. It also explained why t spark sounded different, a differen which may have been more obvious someone with younger ears than mi

Having clarified this much, the actu cause of the trouble was nominat almost automatically—a shorted EH

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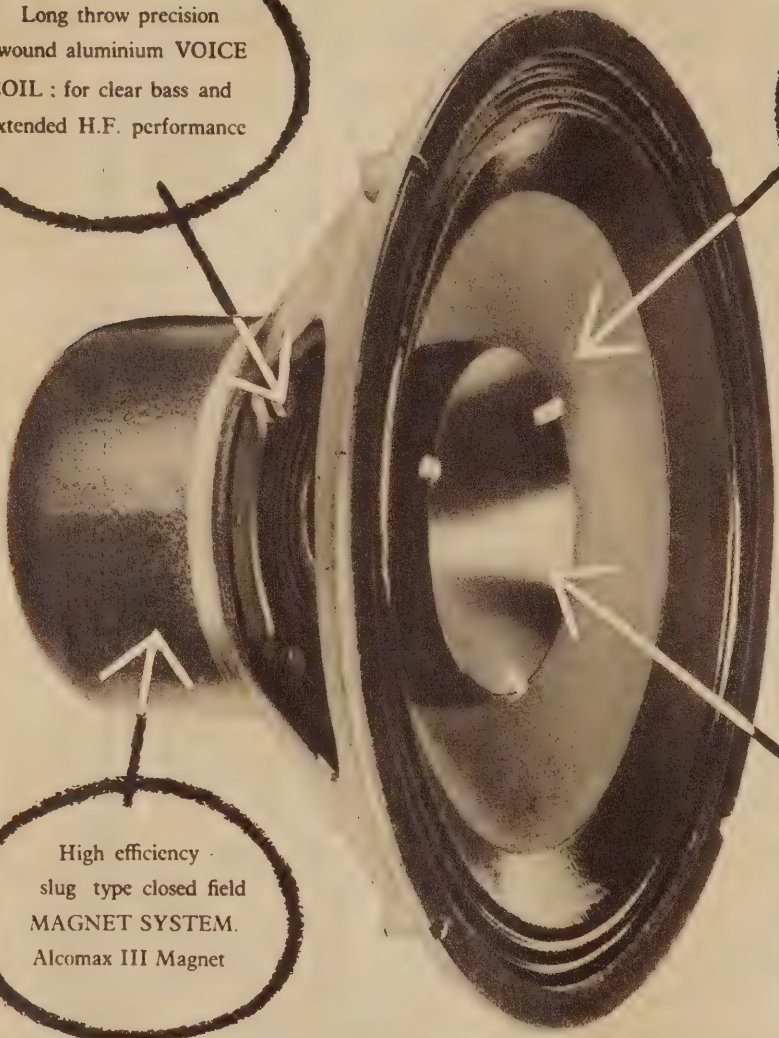

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quickly confirmed this diagnosis.

All things considered, it had not been a very profitable job. What was really a very simple fault had produced symptoms which, taken at their face value, had led to a completely erroneous conclusion. As a result, it had taken a good deal longer than it should have done, with the added unpleasant thought that I might have condemned the picture tube prematurely had I not been careful.

LUCK OF GAME

However, traps like that are simply "the luck of the game," and what one loses in hard cash is gained in experience. I'll wager I won't be caught with that one again. Not for a while, anyway!

My next TV story is interesting mainly because it demonstrates a point I have made on previous occasions, namely, that the "badness" of a fault (if I may use such a term) is not necessarily indicative of the seriousness, either technically or economically, of that fault.

Customers, as a rule, cannot appreciate this point. To them, a fault which produces gross picture distortion in any form must automatically indicate a major component fault and an expensive repair.

I was not surprised, therefore, when this particular customer poured forth a tale of woe about his set's behaviour, then finished up by confessing that he was worried about ". . . what all these repairs are going to cost." The implication was obvious; it was a bad fault, therefore it was going to cost a lot of money.

I must admit that, on such reasoning, he had cause to be worried, because the picture certainly looked horrible even by the average customer's standards. The owner's description of the complaint was ". . . a kind of smear and a lot of dots"; a fairly apt one as it turned out.

BAD SMEAR

The smear was quite bad, and closer examination revealed a multitude of closely spaced repeat images, similar to effect produced by a long feeder line when one side goes open circuit. In addition, there was a bad herringbone pattern (the "dots"), a lack of solid blacks and some evidence of lower than normal gain.

The effect was virtually the same on all channels, and the smear was so bad that I immediately checked the feeder for possible open circuit. However, when this proved to be intact, and considering the other symptoms, I was more inclined to suspect that one receiver fault was responsible for all the troubles.

In particular, I felt that the trouble would be located somewhere in the I.F. amplifier. The nature of the picture, apart from the "ghosts" and herringbone, suggested serious misalignment, while these two symptoms suggested oscillation in some form.

There seemed little point in tackling a fault of this kind on the spot, and I simply slid the chassis out of the cabinet and loaded it on the truck. I'm afraid that only served to confirm the owner's fears about the nature of the fault.

With the set on the bench, the most logical test seemed to be an alignment check. However, because it required very little time, I started off with a general voltage check. As I rather expected, it did not reveal anything abnormal in this case, although it is quite surprising thing significant.

Next I set up the sweep generator and C.R.O. for the alignment check. I fully expected the response curve to be bad, but I hardly expected it to be as bad as it was. There was virtually no shaped response as we normally understand it, just a very narrow, high amplitude peak around 35 Mc. At the same time, there was a definite disturbance along the base line of the trace, almost certainly due to oscillation in some form.

The next question was: why was it like that? One possibility was that one (or more) of the trap slugs had wound themselves out of their own windings into adjacent ones, thus creating the dual effect of setting the trap circuits goodness-knows-where, and detuning main winding as well. It would not be the first time I had experienced such a situation.

CAN BE CAUGHT

On the other hand, one can be caught by taking such an assumption for granted. It is all too easy to dash in and start gaily twiddling cores hither and yon, only to find that it is all to no avail, it being difficult to restore the original response shape.

The reason is simply that the trouble is due to some more fundamental fault, there being little or nothing wrong with the alignment at all. Thus a lot of time is wasted trying to correct the trouble by the wrong method, then a lot more time restoring the original alignment after the real fault has been located and corrected.

For this reason I prefer to check the other most likely possibilities before attacking the alignment adjustments. Even if one draws a blank, the time required is not great, and is a worthwhile precaution. If, on the other hand, one feels that the distortion of the curve is strongly indicative of a wandering slug, then at least proceed carefully, trying one slug at a time and resetting it before attacking the next.

Even a faulty I.F. valve (not necessarily completely defunct) can cause some strange effects, so I took the opportunity to try a known good valve in each socket in turn, checking the response curve as I went. However, this produced no significant change.

FAULTY BYPASS

The next most likely possibility seemed to be a faulty screen by-pass capacitor, particularly as the system seemed to be unstable. So I simply took another .001 ceramic and touched it across each screen by-pass in turn.

By that curious fate which seems to govern the lives of servicemen and others in like occupations, I felt compelled to start at the first I.F. stage and, of course, this turned out to be just about as far away from the fault as it could be. It wasn't until I bridged the by-pass on the last I.F. stage that I achieved any result.

However, it was worth the effort, because the response immediately assumed a normal shape in almost magical fashion. Yes, it was as simple as that, a straight-out open circuit screen by-pass, but quite enough to completely wreck the response curve. And how easy it would have been to upset a group of near-perfect alignment adjustments quite unnecessarily and to no good purpose.

As it was, the job had not been on

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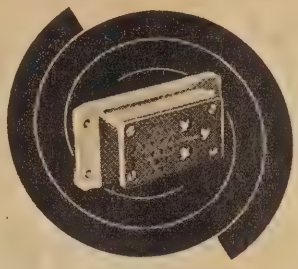

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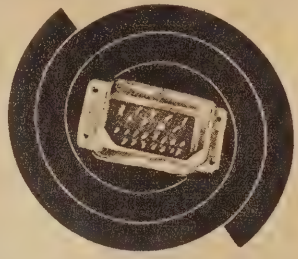

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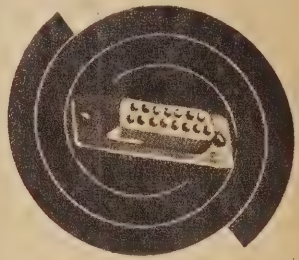

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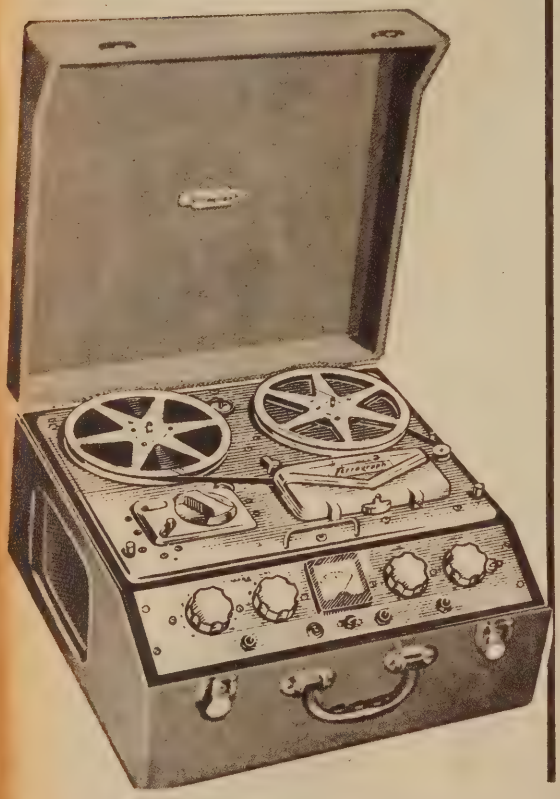

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the bench much longer than it takes to tell the story.

I spent a few moments "touching up" the slugs to correct some minor errors, although these were hardly sufficient to worry about had I not had the alignment gear set up anyway. Then I tried the set on the air. The difference in picture quality was, as might be imagined, quite dramatic. The smear, the herringbone, the poor blacks and all the other troubles had vanished, leaving a picture as near perfect as one could wish.

Happiest of all about the whole thing was the owner, when I told him that only a minor component was involved and that he would be charged only a normal service fee —not the cost of completely rebuilding the set or something equally drastic!

☆

This close - up photograph shows the corrosion of the battery connector and the battery case, cut away, as described.

☆

Another point this story emphasised is that not all ghosts or repeat images are due to aerial and feeder troubles. While it is true that this usually is the case, it is equally true that certain forms of multiple images can be generated within the set.

INSTABILITY

Almost any form of instability can create this effect, whether it be in the tuner, I.F. strip, or video amplifier. It is not necessary that the system be continuously unstable, merely that it be capable of being shocked into oscillation by sudden changes in signal amplitude ("ringing").

The effect is not the same as that produced by an isolated reflecting surface, which may produce a single ghost well removed from the main image. Instead, it produces repeat images very close together and varying in number according to the severity of the ringing. It may often be referred to as smear, since the individual repeat images are not always immediately apparent, except on close examination.

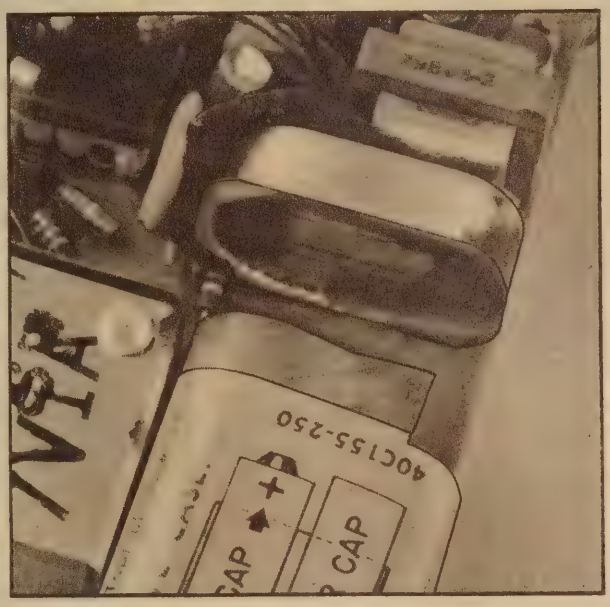
However, the effect can be similar to that produced by one open feeder wire or a long feeder incorrectly terminated and exhibiting pronounced standing waves. For this reason, it may be necessary to check the aerial system before one can be sure whether the trouble is inside or outside the set.

And finally a small story about a transistor portable.

"There's not much wrong with it," he said, as he pushed it across the counter. "Just wants new batteries, I think. I'll drop in and pick it up tomorrow, if that's OK. I'd like to have it for the weekend."

I assured him that, if the batteries only needed replacing, he could certainly pick it up the next day. Rather foolishly, perhaps, I didn't bother to open the case while he was there.

When I did a horrible sight met my gaze. The batteries were obviously very flat and, equally obviously, had been that way for a long time. As is usual with batteries in that condition, most of their inside was outside, spreading in a corrosive wave across the baseboard of the set.



The set was of local manufacture, and the batteries, four small penlight cells, were housed in a long oval case made from a composition material. One end was permanently sealed with a metal cap, while a second similar metal cap was fastened to the baseboard of the set. This carried the insulated terminals for connection to the battery.

The batteries were held against these contacts by a light spring in the opposite end of the battery case, while the case itself fitted neatly inside the fixed metal cap. Altogether it was a rather neat arrangement or, rather, it had been until the batteries burst.

The combination of corrosion and expansion had securely wedged both batteries and the battery case inside the metal cap. I had to use considerable force to free them, and then only at the expense of the battery case, which I could not avoid tearing.

CLEANING UP

With the batteries out of the way I set about cleaning up the mess and assessing the damage. Fortunately, most of the "goo" had settled on the bakelite baseboard and had not yet reached any vital components. After I had wiped it away and cleaned things up with a metho-soaked cloth, it looked rather less gruesome.

The worst casualty appeared to be the metal cap and the battery case. The former was badly rusted over about half its area, with part of the metal actually eaten away, while the case had been torn, as already described.

Fortunately, the two contacts in the cap had escaped damage and I was able to render the thing servicable again — at least on a temporary basis—by scraping away the corrosion and loose rust. The case I simply trimmed up with a pair of scissors.

It was a rough repair, and I didn't intend it as anything other than a temporary one, with the idea of replacing both parts as soon as I could arrange delivery from the markers.

The real point of the story, however, is that people continue, in spite of warnings on batteries and in instruments, to leave discharged batteries in delicate and expensive equipment, often with disastrous results. In this case the owner was fortunate, but in a few more days the mess would have reached one of the tiny audio transformers just behind the battery cap.

WHAT TO DO?

I don't know what can be done to help educate the average non-technical user to appreciate this hazard, and it may well be that the problem will have to be solved from another angle, namely, the provision of more stable or more robust batteries at little or no greater price than the current types.

In any case, a slight increase in cost for such batteries should not be a serious objection, considering the low running cost of modern sets. On the other hand this economy presents its own hazards. Owners seem to be becoming more and more careless about switching them off after use, apparently considering the few shillings involved not worth bothering about.

But then, as I've said before, why should I be worrying? If things didn't happen to radio sets, I'd be out of a job

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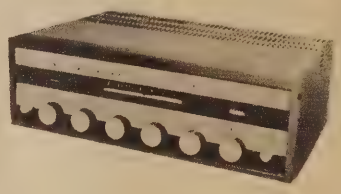

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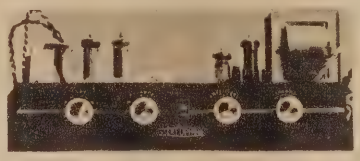

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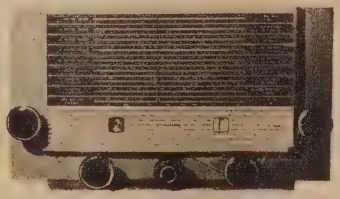

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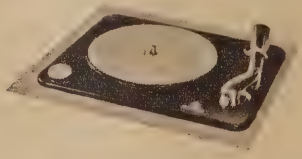

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A833

Here's your answer, Tom!

The flow of current in an electric circuit has long been explained using the "water-in-a-pipe" analogy. This, in common with many analogies, can lead one astray if carried too far. Tom's first question shows just how far astray this analogy can lead a beginner.

When I examine typical circuits, I find that various parts of the circuit are connected to earth. If electric flow is like water in a pipe, why don't all the electrons in the circuit flow off into the earth and render the whole circuit inoperative?

Well, Tom, that's rather a big question, but we will make an attempt at answering it.

To start with, an electrical conductor or wire is not like a pipe for a stream of electrons, which can be variously empty or full. The atoms of the metal composing the wire, as you possibly know, are like small solar systems, with electrons whizzing around the centre "nucleus." These electrons are negatively charged.

The electrons continue to revolve around the nucleus unless an electric or magnetic field is applied to the wire, perhaps by the application of a battery to the ends. An electric field is the same sort of thing that attracts small pieces of paper to a charged comb.

When such a field is present, the outermost electrons in each atom make small jumps from one atom to an adjacent atom. The jumps all tend to be in the one direction, according to the applied field. The net effect is a flow of electrons towards the positive terminal of the battery or the positive end of the circuit.

NO CURRENT FLOWS

In the absence of any field, no clearly defined electron movement occurs. The electrons simply jump to and fro in random fashion, due to thermal excitation, but this random movement does not constitute a flow in a particular direction.

Connecting a circuit to earth can have no effect at all, unless the circuit is somehow at a potential with respect to the earth. If such a potential does exist, an electric field will be set up in the connecting wire, and electrons will move along it; in other words, a current would flow in the earthing circuit.

For the most part, in radio and electrical appliances, electrons are induced to flow along specific paths within the appliance, in order to produce the desired effect. They will flow readily from one point in the circuit to a more positive point; there is no reason for them to flow to earth unless, as we said earlier, a potential difference exists which induces them to do so.

Circuits are nevertheless connected to earth for a variety of reasons.

In a radio receiver of the type using a single wire aerial, a ground of some sort is necessary to provide a return path for the radio signal, as this appears as a voltage across the aerial-ground "capacitor."

Power transmission systems are usually connected to earth in some way, in order to dissipate potentials which might otherwise accumulate unnecessarily on the wiring or appliances connected thereto.

High gain amplifier systems are commonly connected to earth to minimise the risk of "hum" voltages appearing on the chassis from the power supply wiring and ultimately penetrating the signal input circuits.

★ ★ ★

Q.: In some amplifier circuits, the plate of one stage is connected directly to the grid of the next stage. Why doesn't the high tension of the first valve interfere with the operation of the second valve?

A valve in a normal circuit, operated as a class A1 amplifier, will function correctly provided the control grid does not go positive with respect to its own cathode. The normal operating potential of the grid is, in fact, some few volts negative with respect to cathode.

In a direct-coupled type amplifier, often used for DC amplification, the grid of the second valve is directly connected to the plate of the preceding valve and may thus be some 200 volts positive with respect to the chassis.

The correct grid-to-cathode voltage is maintained, however, by arranging the circuit so that the cathode of the second valve is at a still HIGHER positive voltage with respect to the chassis. This means that, as far as the valve is concerned, its grid is still slightly negative with respect to its cathode and normal operation is preserved.

There remains one problem, however. Since, for normal operation, the plate of a valve has to be a hundred or more volts above the cathode, and in this circuit the cathode in the second valve is already 200 odd volts above chassis, its plate must be at a very high voltage, say about 400, with respect to chassis.

This means that directly coupled amplifiers require higher than normal supply voltage and considerable care has to be taken in the original design to achieve and preserve correct valve operating conditions.

For these reasons they are less popular than the resistance-coupled type, even though direct coupling has some advantages.

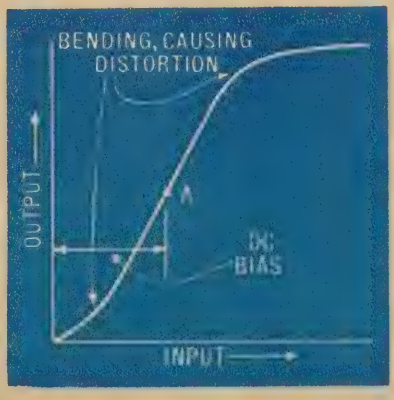


Diagram showing effect of DC bias on operating point of magnetic tape.

★ ★ ★

Q.: Why do some types of DC motors "take off"?

A.: Perhaps, Tom, they hear the "Call of the Wild"!

But seriously, Tom, DC motors can "take off" or "run away" at destructive speeds in certain circumstances.

The first involves motors which derive a major proportion of their magnetic field from a shunt field winding, or winding whose current does not flow through the armature circuit.

It occurs when such a motor, running with a light load, is suddenly deprived of current in this field winding, due to either a fault in the motor itself or in the connecting cables.

When a wire carrying an electric current is moving transversely across a magnetic field, due to the force experienced by the wire, an electro-motive force (EMF) is generated inside the wire tending to cancel the "driving" current.

This EMF, called a "back EMF," is proportional both to the strength of the magnetic field and to the speed of the wire with respect to it.

In a motor, the EMFs in the rotating armature add to one another, so that for the given magnetic field a speed is normally reached when the back EMF equals the applied armature voltage.

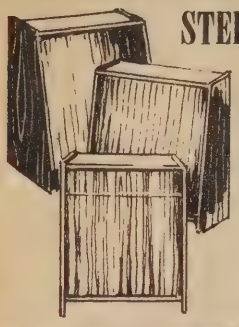
An equilibrium is thus reached and the motor stays at this speed for, if it speeds up, the back EMF is bigger than the applied voltage and the motor acts as a generator.

If it slows down, it draws more current, as the back EMF lessens, so it experiences more driving force and speeds up again.

If field current disappears, however, the magnetic field does not immediately drop to nothing, but takes a significant time to do so, due to the magnetic

SOUND ADVICE... See ARROW first!

STEREOGRAM CABINETS



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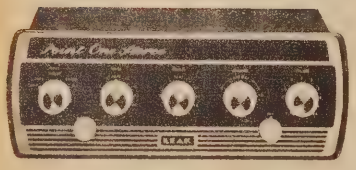

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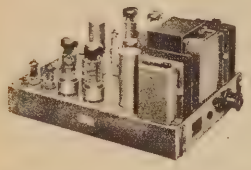

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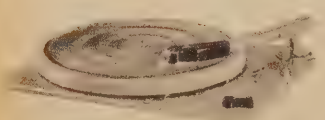

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"lag," or remanence, of the iron in the motor.

When the field thus begins to reduce, the motor must speed up to keep up its back EMF, which also reduces, so the motor "takes off," speeding up quickly, and will fly apart unless the armature current is quickly removed.

There is another reason why a motor "takes off," Tom, namely in the case of the series-wound DC motor. This type of motor, which has the field in series with the armature, will "take off" if its mechanical load is removed. If the motor increases speed, due to the decreased load, the back EMF goes up and the motor armature draws less current.

When this happens, the field current also decreases, since it is in series with the armature. With reduced field current, the magnetic field also goes down.

To keep up its back EMF, the motor must now speed up still more, as it has less field to turn in. So the speeding-up continues, until disaster follows and the wire flies out of the armature by sheer centrifugal force.

For this reason, great care is taken to see that series motors always have a load connected.

★ ★ ★

Q.: Is there such a thing as DC bias in tape recording, and if so, why isn't it used nowadays?

A.: Yes, Tom, there is such a thing as DC bias and it is used today in a few portable battery-operated recorders and also in some other low-priced machines.

In magnetic tape recording it is found, that, due to the non-linearity and lagging effects on the magnetic materials used, distortion of the signal occurs at both high and low values of recording level. If we were to draw a graph relating input to output of the tape, we would obtain something like that shown.

The effect of DC bias is to displace the operating point to the point A by means of a steady direct current in the recording head, as well as the signal. This means that, in the absence of any signal, the tape still has a certain magnetisation, rather than none at all. This reduces distortion no end, but it is found that magnetised tape is noisier by about three times (10db) than non-magnetised tape.

High frequency bias obviates the distortion problem, allows higher amplitude to be recorded on the tape and leaves the tape with no "standing" bias, thereby keeping the noise level down.

★ ★ ★

Q.: What is an ignitron?

A.: An ignitron, Tom, is a type of mercury-arc rectifier, used in industry for obtaining large amounts of direct current from an AC supply.

The mercury arc type of rectifier relies on the fact that an electric arc drawn from a pool of mercury will pass current in one direction only, electrons being able to pass from pool to arc, but not the other way.

When used to rectify AC, however, the arc would normally extinguish at each current reversal, when the applied voltage is zero. To overcome this, a polyphase rectifier may be used, in which there is always one plate positive, the arc merely jumping from anode to anode.

Alternatively, the arc is ignited at the start of every positive half-cycle. This latter method is the one used in the ignitron, where at the beginning of every positive half-cycle, the arc is started afresh by an element in the device called the ignitor.

Large water-cooled ignitrons, rectify currents of hundreds and thousands of amps.

★ ★ ★

Q.: Is an electro-magnetic horn a kind of musical instrument?

A.: No, Tom, an electro-magnetic horn is a signal-launcher, or type of aerial. They are used in extremely high-frequency equipment such as in radar and microwave gear, and are made in quite a number of shapes. At these very high frequencies the signals are "piped" along in plated copper pipes, called waveguides, and are propagated in the air at the end of the waveguide by the electro-magnetic horn, which looks like a type of metal funnel.

It may also look like a piece out of your bath-heater, Tom, or a musical instrument, but it does an entirely different job!

★ ★ ★

Do large Transmitting Valves have cathodes ?

Well, Tom, all thermionic valves have cathodes, in one form or another. But whether it is a directly heated or "filament" type, or perhaps an "indirectly heated" or "unipotential cathode" type, is a different matter.

Large transmitting valves, which operate at quite high temperatures and field intensities, often are provided with tungsten or thoriated tungsten filament type cathodes.

This is for a number of reasons, one being that these valves are usually repaired rather than thrown away and replaced.

The oxide coatings used in the unipotential type of cathode are ruined on contact with air once "formed," and thus would have to be replaced each time the valve was opened to repair it.

This type of cathode is also unsuitable for high-temperature and high field-intensity work, so most transmitting valves use the filament type cathode.

Any Questions Tom?

We reserve these two pages every month to answer the simple unconnected questions which are put to us by readers. Perhaps you've some questions you'd like answered. Write them down and send them to the Editor endorsed "Here's Your Answer, Tom."

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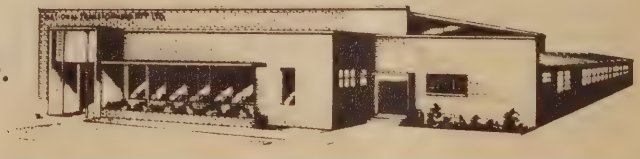

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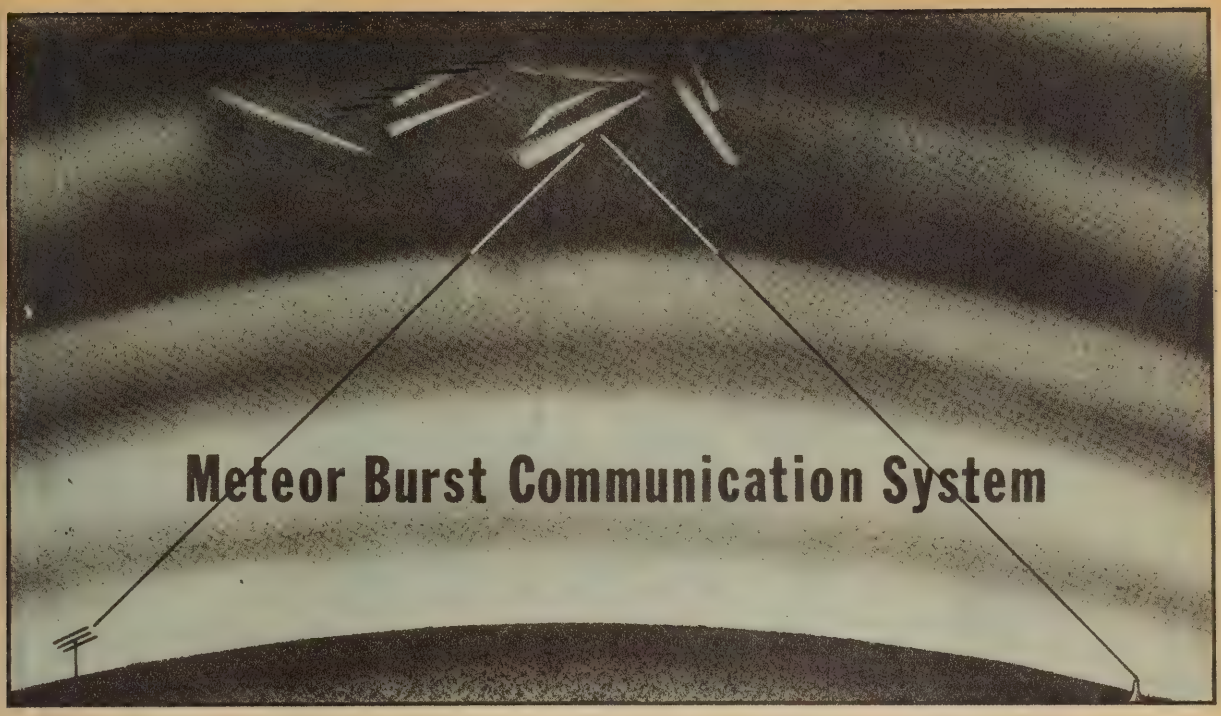

Meteor Burst Communication System

An experimental radio communication system that uses meteor trails for two-way message transmission has recently been developed by the Boulder (Colo.) Laboratories of the U.S. Bureau of Standards under the sponsorship of the Air Force Cambridge Research Centre. With this system, messages have been sent at speeds up to 4,800 words a minute — 80 times the present speed of transmission by teletype.

THE system resulted from a three-year investigation, conducted by R. J. Carpenter and G. R. Ochs, of the N.B.S. Central Radio Propagation Laboratory, to determine the feasibility of a long-distance vhf communication system based on reflections from meteor trails.

Results of the study indicate that intermittent meteor-burst communication can compete effectively with other long-distance systems, and that it is relatively free from ionospheric disturbances, which affect long-distance communication in the high frequency range.

MILLIONS OF METEORS

Millions of tiny meteors enter the earth's atmosphere every day, only to burn up before they can fall to the ground.

When a meteor reaches the lower part of the ionosphere, the heat due to air friction vaporises some of the meteoric material, creating a trail of electrons and ionized atoms behind the meteor about 15 miles long.

As this trail reflects radio waves, it causes short-time enhancement of radio signals.

Because of the transient nature of meteor trails, they cannot be used continuously to transmit radio signals. Thus a communication system using this phenomenon requires a new approach to message handling and control.

The system must operate intermittently at very high speed, and must go into operation automatically when a suitable meteor trail is available for signal enhancement.

Obviously there must be some provision for storing messages during periods when no suitable meteor trail is available.

In recent years the overcrowding of the high-frequency bands traditonally used for long-range communication has stimulated investigation of various vhf and uhf communication systems.

One result of this work has been the development of ionospheric forward scatter propagation—another promising vhf communication system. In contrast to meteor burst communication, forward scatter provides a continuous signal.

However, the meteor burst system has the advantages of lower power and smaller antenna requirements, a wider usable spectrum, and greater security in message transfer.

LESS JAMMING

Because of the highly directive character of meteor burst reflections, there is less jamming and interference caused by reception of signals from other transmitters.

In the Bureau's system, two magnetic tape recorders handle the storage of incoming and outgoing messages at each transmitting-receiving station.

Normal teletype messages to be transmitted are first recorded on magnetic tape and then sent at high speed.

Received messages are recorded on magnetic tape at high speed and then printed at normal speed.

The system's control equipment determines when conditions are acceptable for transmission of messages.

This decision is based on: (1) The amplitude-versus-time characteristics of the received signal; (2) the modulation of the received signal; (3) the availability of storage space for incoming messages; and (4) the availability of messages for transmission.

In order to measure attenuation on the two oppositely directed radio paths, the transmitters at both stations are kept in continuous service.

With both transmitters on the air, the system can detect the presence of a suitably located meteor trail within a few thousandths of a second.

When either station "hears" a signal reflected by a meteor trail, it shifts its transmitting frequency, thus indicating to the others its readiness to transmit messages.

After both stations have received this signal, message transmission is initiated.

Should either terminal run out of magnetic tape or should the signal strength fall too low, the two stations "converse" with each other and agree to stop transmission temporarily.

STOPS AUTOMATICALLY

At the end of a meteor burst, signal fading or obvious error in received messages causes the system to stop transmitting, and the transmitters return to their original frequency.

Under normal conditons, the command to start and stop and associated events are so timed that no messages are lost.

The experimental meteor burst-system was designed for a study of two-way communications over paths from 400 to 1,200 miles in length.

Preliminary tests were made over a 390-mile path from Sterling, Va., to Walpole, Mass. However, an 800-mile path from Kilbourne, Ill., to Erie, Colo., was used in most of the investigations.

At the field sites the equipment was housed in 24ft trailers.

The system's receivers are double-conversion super-heterodynes. Each contains an FM detector for messages and

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an AM detector to measure signal strength. With each change in speedup ratio, the transmitter frequency shift is changed.

Then it becomes necessary to match this change by a change in the electro-mechanical filter in the receiver. This filter sets the receiver pass band to correspond to the modulation.

SECOND FILTER

Another filter, located between the antenna and the receiver, rejects signals from the system's adjacent transmitter—an unavoidable source of disturbance because of its proximity to the receiver.

With this filter (a quarter-wave-length resonant-line tuned circuit), it is possible to operate with only 480 kc difference between receiver and transmitter frequencies.

The transmitters are commercial units intended for base station use in mobile communication service. They were operated at 49 mc with a power output of 2 kw. Frequency control is by a D.C. coupled, frequency-modulated exciter. The deviation of the transmitter is adjustable so as to provide shifts of 800, 2,000, 3,700 and 5,000 cps at the output frequency.

The antenna system is composed of two arrays, each consisting of two five-element Yagi antennas. To reduce the effect of a strong local transmitter on the sensitive receiving system, one array is always used for receiving, the other for transmitting.

Also, contrary to the usual convention, the two antennas of each pair are fed out-of-phase to produce a split-beam patter with a null on the great circle connecting the stations.

This arrangement made it possible to aim the signals at directions most suited to the meteor burst path, inasmuch as most meteoric propagation takes place on either side of the great circle path. The antenna design is based on meteoric ionisation at an elevation of 110 km.

Because of the complexity and high-speed operation of the system automatic monitoring devices were used to analyse its performance. This was found to vary considerably with equipment settings and atmospheric conditions.

TYPICAL FIGURES

For instance, from 1.00 p.m. May 8, until 12.30 a.m. May 29 (1958), 122,880 characters came over the Kilbourne receiver with only five errors—an error rate of 0.004 per cent at 30 words/min.

This record was in contrast to an error rate of over 10 per cent in the small number of characters received under the worst conditions of thunderstorm and precipitation static.

The characteristics of the signals received during the experiments indicate that it is advantageous to operate intermittently at transmission speeds higher than the average signalling rate.

Varying the operating threshold and speed-up ratios constituted one phase of an investigation of the system parameters. Analysis of the data indicates that error rates can be reduced significantly by rejecting certain portions of the meteoric signals.

From the data on speed-up ratios, it appears that the system operates most effectively at 2,400 words/min. (40 times normal teletype speed).

With this speed and a suitable operating threshold setting, a daily average of 40 words/min. may be expected at a character error rate of 0.35 per cent.

Higher transmission rates should give better results if improved control systems and rapid-access storage facilities can be substituted.

At lower transmission rates, noise interference is a greater factor as the signals have to remain error-free for a longer period of time for transmission to be successfully terminated. This results in an increase in the probability of error.

The experiments indicate that signals from two coexistent meteor trails occur frequently enough to be a serious source of error.

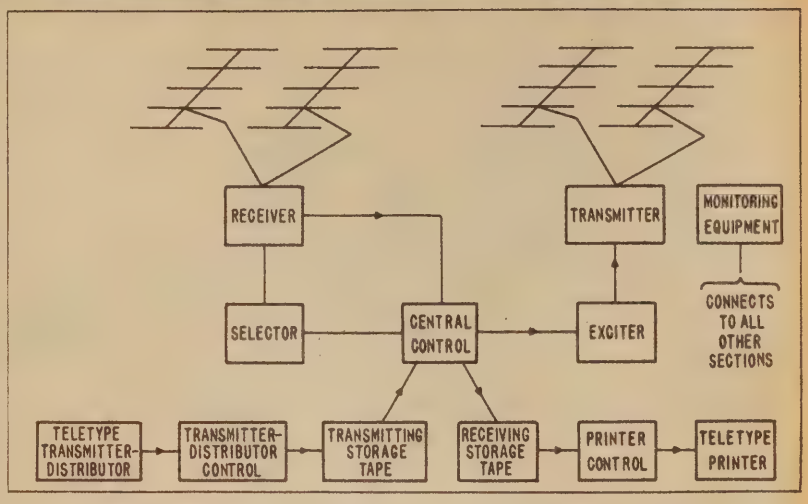
The system is also seriously affected by electrical storms, precipitation static, and nearby ignition systems and power lines.

Other sources of interference are ionospheric forward scatter, sporadic E-layer propagation, and at the higher-latitude installations, auroral-reflected signals.

Tropospheric scatter signals are a problem, but only over fairly short paths, 100 to 200 miles in length.

To avoid these sources of interference, the Bureau recommends that a practical meteor burst communication system contain an automatic device for setting the system's threshold at a fixed margin above the short-term median signal strength.

HOW THE NEW SYSTEM OPERATES



Block diagram of the meteor burst communication system.

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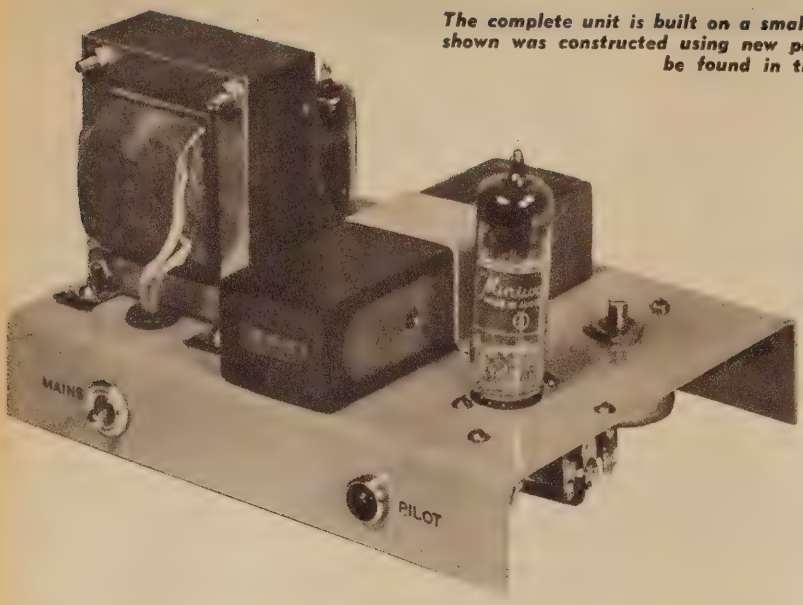


The complete unit is built on a small aluminium chassis. Although the unit shown was constructed using new parts, almost all the components could be found in the "junk box."

Counter Records Elapsed Time

Intrigued by the relay counters currently available from disposals sources, we set about to devise a circuit which would make them count—in this case periods of elapsed time. We reasoned that there must be many uses for a device which would record for how long items of equipment had been in use or under test.

TYPICAL counters available are able to count up to 9,999 pulses, so that a unit embodying such a counter, if set to operate every minute, can record time up to 166 hours. This is many times longer than can be shown on an ordinary self-starting synchronous clock face.

The period could, for example, "take in" the running time of important pieces of machinery which needed lubrication at certain intervals—not just at any old time someone thought they should get a squirt of oil!

Again, in a completely different field, a timer could record the amount of use given a record-playing stylus, either for purposes of test or to indicate when replacement was due.

You may think of many other possible applications.

TIME TEST

Radio servicemen may be able to use one to record "officially," and for the customers' benefit, how long a doubtful set has been running on the test bench.

Refrigerator or air-conditioning technicians may want to know about the running time of particular units in particular locations. And so on. . . .

In many cases, it could be sufficient to arrange the switching so that the timer comes on at the same time as the device to be monitored. It could, for example, be wired in parallel with the actual turntable motor of an amplifier and controlled by the same switch.

Provided the periods of operation were fairly long as, for example, the playing time of LP or EP records, inaccuracy due to the timer warm-up period would not be very great.

SHORTER CYCLES

If shorter duty cycles are anticipated, however, it would be better to leave the heaters of the valves running and use any available switching to close the HT circuit.

Thus, where amplifier equipment is used to play many single numbers, the timer could be arranged to come on, whenever the equipment, as a whole, was switched on. The HT circuit would be completed only when the pickup was in use—either by using a microswitch as the pickup rest or else using a double-pole motor off-on switch, with the second pole closing the timer HT circuit.

Another use which suggests itself is in the speeded-up motion type of movie-film.

Such "tricks" as showing the growth of a plant, the opening of a flower, or clouds moving quickly across the sky are examples of this type of filming. The camera technique used involves setting up the camera, and arranging it so that one single frame is taken every so often.

The time between frames, naturally, determines the degree of speeding up which occurs when the film is projected at the standard speed.

This unit is ideal for this application, as it provides on the counter an indication of the total number of frames taken, in addition to the actual timing operation.

CAMERA RELEASE

The only modification necessary is the adaption of a relay or solenoid to operate the camera release button. This solenoid can be operated from the auxiliary contacts on the counter, so supplying the solenoid with the necessary operating current each time the counter trips.

The main problem involved in the using of such a counter is the source of operating current. A typical unit has a coil resistance of 1,300 ohms, pulls in at 42mA, and drops out at 15mA. Thus a pulse is necessary, ranging from less than 15 milliamps to greater than 42, and of duration long enough to operate the solenoid and mechanism reliably.

To provide such a pulse, many schemes come to mind. A few of these, such as a neon-tube relaxation oscillator, a self-timing relay using its own contacts, and devices which utilise charging capacitors, were tried out, but they all had disadvantages, when relatively long timing periods were aimed at.

Finally, a multivibrator circuit was tried along lines similar to those used in television vertical deflection circuits. When high-value resistors and capacitors were inserted to obtain long timing periods, the circuit continued to operate reliably and accurately. The final unit chosen is of this type.

MULTI-PURPOSE VALVE

The valve used in the circuit is a 6BM8, a multi-purpose triode-pentode in which the pentode section is suitable for output applications.

The counter is wired in the plate lead of this section, wired as a triode, so that it is operated when the pentode section is conducting. The multivibrator is supplied with HT from a conventional full-wave rectifier circuit using a 6X4 valve and a small 50mA transformer.

There is no reason, however, why the power supply should not be built up

using old components from the junk box.

Indeed, even in the oscillator itself, older valves and components could be used, provided they are of the right general type. The two large-value coupling capacitors used in the oscillator circuit must, however, be in good condition, otherwise the device will be unreliable and incapable of generating the long pulses desired.

Now for an explanation of the operation of the circuit, using the terms "triode" and "pentode" to describe the two sections of the 6BM8.

Since one must select a starting point in describing the cycle of events in a multivibrator circuit, let us assume that it begins with the applications of HT.

VOLTAGE RISES

When, therefore, HT is applied to the circuit, the voltage at the plate of the pentode section rises, as current rises through the resistive and inductive load provided by the relay coil.

As the plate voltage rises, the 4 mfd capacitor connected to it charges, the charging current flowing via the grid circuit of the triode and in such a direction as to make the grid slightly positive.

This "positive-going" voltage at the triode grid produces a rise in triode plate current and, therefore a fall in triode plate voltage.

This fall in plate voltage is communicated by the 2 mfd coupling capacitor to the pentode grid as a negative-going signal. This forces a reduction in pentode plate current, with a consequent rise in plate voltage, thereby sustaining the "positive" signal to the triode grid.

The process continues until the pentode plate current is cut off, after which the positive-going signal to the triode grid must disappear.

The first portion of the cycle therefore reaches a climax with the triode conducting heavily and the pentode cut off. The condition is reached very quickly because the 4 mfd capacitor charges rapidly through the "diode" formed by the cathode and grid of the triode.

The condition just described cannot be sustained. The negative voltage at the pentode grid diminishes as the 2 mfd coupling capacitor discharges through the 2 meg. resistor. Since the time constant of the combination is 4 seconds, the grid of the pentode takes something like this amount of time to rise above cut-off level.

EFFECT ON CAPACITOR

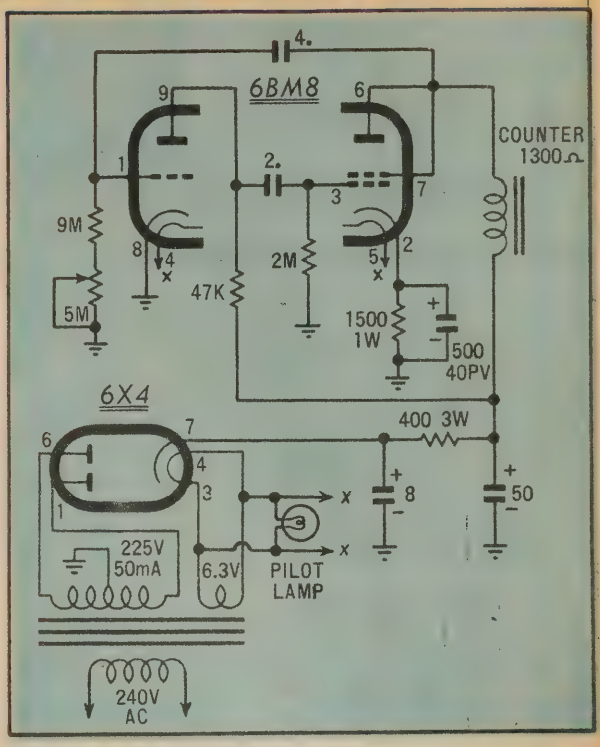
When it does return to a point where the pentode section can conduct slightly, the pentode plate current rises and the plate voltage falls.

This tends to discharge the 4 mfd capacitor through the 14-or-so-megohm triode grid leak. Due to the amplifying action of the triode, this appears as a fall in plate current and a rise in plate voltage passing a positive pulse to the pentode grid.

Thus the action "snowballs" and the circuit rapidly "flips" over to the pentode conduction period, with the triode grid at a large negative potential with respect to earth.

This very large potential has to be reduced to a very small negative voltage before the high-mu triode section

CIRCUIT OF THE TIMER-COUNTER



As can be seen, the counter is basically a multivibrator arranged to have a very long operating cycle. Auxiliary contacts on some counters may be used to operate low wattage relays and solenoids.

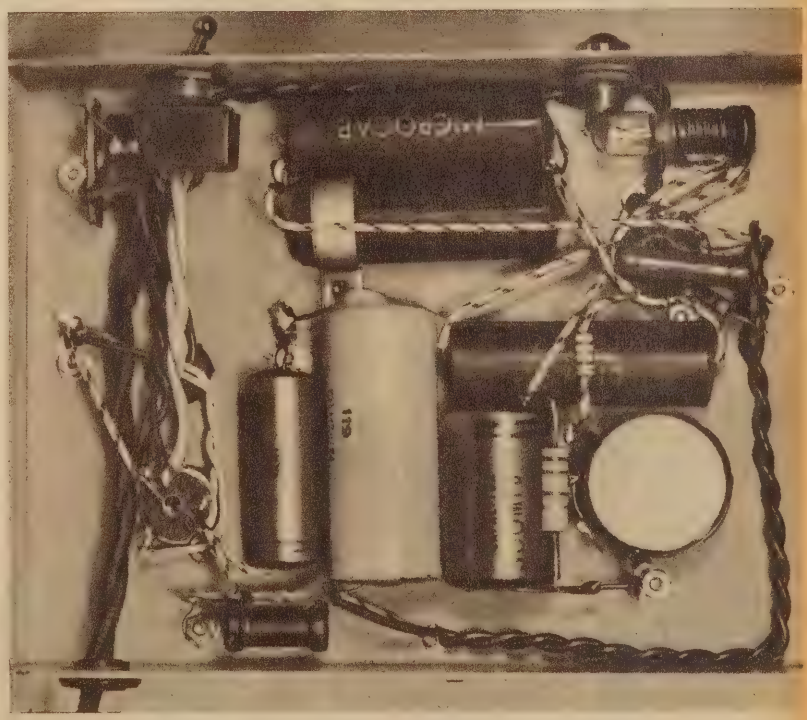
can conduct and, due to the large values involved (4 mfd and up to 14 megohms) the process takes about one minute.

The pentode section, however, which has received a strong positive grid pulse during the "flip" over, drops back to a value of plate current of something under 20mA. This is because the cathode bypass capacitor quickly charges during the large initial plate current pulse of the "flip" and soon applies a limiting bias to the valve.

Thus the counter receives a strong pulse of current to pull it in, and then the current drops to less than 20 mA.

When the 4 mfd capacitor in the grid circuit finally reaches a point where its discharge current drops sufficiently to

(Continued overleaf)



The wiring and layout shown here is intended as a guide, but may be departed from as the layout is not particularly critical.

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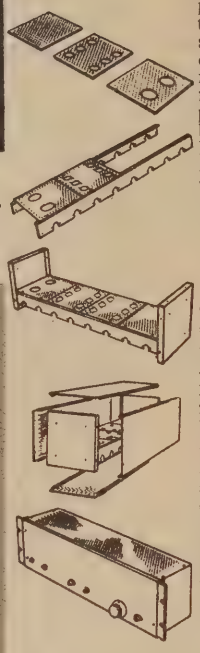

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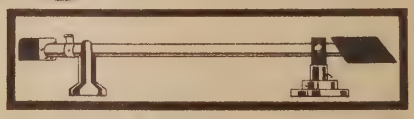

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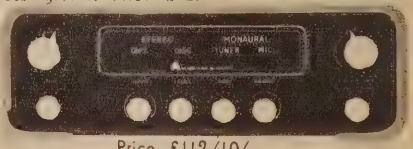

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allow the triode grid to rise slightly above cut-off, the circuit "flips" back to the alternative condition with the triode conducting and the pentode cut off

From the foregoing, it will be evident that the very slow pulse rate is achieved mainly in the triode grid circuit. There is good reason for this because a large value of grid resistor can be used without transgressing the ratings.

The pentode must be held at cut-off long enough, however, for the relay to drop right open, and this is the reason for the unusually large coupling capacitor to its grid.

The pentode cathode resistor, by the way, controls the value of plate current to which this section returns after the pulse which trips the counter.

If another valve is used in the circuit, this resistor should be selected so that the current during this period is a value which will not harm the valve or the counter. A value of 15 or 20mA should be aimed at here, and the size of resistor needed can be found using the valve curves or by experiment.

Now for the constructional details of the unit. Our model was built up on a simple U-shaped chassis of aluminium,

TIME CONVERSION TABLE

Hours	Minutes
1	60
2	120
3	180
4	240
5	300
6	360
7	420
8	480
9	540
10	600
11	660
12	720
13	780
14	840
15	900
16	960
17	1020
18	1080
19	1140
20	1200
25	1500
30	1800
35	2100
40	2400
45	2700
50	3000
55	3300
60	3600
65	3900
70	4200
80	4800
90	5400
100	6000

and finished in grey lacquer. As can be seen in the photograph, the wiring and layout of parts is not critical, and almost any chassis or type of construction is permissible.

The counter was placed on the top centre of the chassis and held in place with a strip of aluminium bent into a clamping band.

The power transformer and rectifier were arranged on one side of the chassis and the multivibrator circuitry on the other.

The large value capacitors, by the way, may prove a little difficult to obtain "over the counter." If this is the case, we suggest that you arrange that your normal supplier orders them from the manufacturer's agents. The units

CARRIER CONTROL FOR TRAINS

(Continued from Page 74)

in a piece of insulating tape, to prevent it from touching the body of the transistor. This would not affect the normal operation of the circuit, but would render the protective property of the diode useless. With careful construction, the unit can be made quite small, and easily fits in a standard "HO" or "OO" covered van or tender.

This completes the simple system, which does not provide any reversing facility at all. For those readers who are "lost" without some form of reversing, however, there is a simple modification which can be made to the simple system to provide this feature.

As can be seen in the modified circuit diagram, the changes needed are only in the receiver unit, and are only slight. The OA31 series protective diode is removed from its original position in the circuit and wired so that it shunts the power transistor when the supply polarity is reversed. Thus it allows the motor to be connected directly to the line when the polarity is changed, by shorting out the transistor.

This is necessary, because with reversed polarity the transistor becomes a very low impedance across its collector-base junction, and a relatively high impedance across its base-emitter junction, which is then reversed biased. This causes the full supply voltage to appear across the base-emitter junction, and no data is available on the maximum voltage allowable in this connection. With the diode in position across the transistor, however, very little voltage is then applied (only the forward voltage drop in the diode) and all is well.

However, the full supply voltage now appears across the base-emitter junction of the OC72 diode. This is prevented by wiring another OA5 diode in series with the emitter lead of the OC72. The diode has a reverse breakdown voltage much in excess of the voltage available here, and so protects the OC72 transistor stage. The impedance in the base circuit also becomes quite high with reversed polarity, as it also has a OA5 diode in series.

The operation of the circuit when the rail polarity is reversed, then, is to disable the transistor circuitry completely, the motor being under control of the rheostat in the conventional power supply in the normal way. Thus, when it is desired to reverse one train, all trains on the same track are reversed. This means if individual control is to be maintained, the block control system must be retained.

The reversing feature has thus been included at the cost of limiting the versatility of the individual control. However, for main-line operation, where reversing is not used overmuch, the system allows individual control of trains. At terminals and goods yards, however, the older block system will have to be retained until a better system is developed.

GRID RESISTORS

A point which should have been mentioned earlier is in reference to the preset potentiometers in the grid circuit of the oscillators of the Transmitter unit. These are used to control the amount of feedback, which should be just high enough to ensure reliable operation. Too much feedback causes distortion of the output wave.

This will cause harmonics of the oscillator frequency to be fed to the track and may cause trouble if many trains are used at widely differing carrier frequencies. If only a couple of trains are to be run, however, the potentiometers could probably be left out and grid leaks of the same value used instead.

used in the prototype model were AEE "MICROCAP" types, and are handled by Wm. J. McLellan and Co. Pty. Ltd. Other manufacturers may have equally suitable types.

The preset potentiometer visible on the chassis is the adjustable triode grid leak, which controls the counter timing. This is normally set so that the average timing period is one minute.

We had no special difficulty in getting the original accurate to within seconds over half-hour periods.

We say "average" because individual cycles may vary by a second or so, either way, due to temperature, mains fluctations, etc. We suggest an initial setting against a sweep second hand or stop watch, followed by a "touching up" over longer periods to obtain greater accuracy.

The accuracy of the unit will depend to a certain extent on the stability of the high-value grid resistors, incidentally. These should be high-stability types where the highest accuracy is required, or if economy is imperative, large wattage sizes can be put into service.

This, then, completes the timer. Although it is simple in circuitry, and uses but a few components, we feel that it will find a lot of unusual applications.

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TECHNICAL BOOK REVIEW

"ANTENNES," by H. J. A. Smit and A. J. Dirkson. Soft cover, 5½ v 8in, 191 pages. Diagrams, tables of data and photographs.

This book, intended to be a complete guide on aerials, is written in Dutch, so a complete report on the contents is a little difficult.

However, judging by the diagrams, data tables, photographs and circuits, the book appears to be quite comprehensive in its coverage. Almost every phase of aerial theory seems to be covered to some extent, and feeding, matching and directivity are covered for almost every type of propagating device.

Antennas for the frequency range, including short-waves, right up to that including micro-waves and radar, are covered, and effects of parasitic elements on each type of aerial are discussed, with reference to the directivity.

Our copy was from th publishers, De Muiderkring N.V., Bussum, Holland, and the Australian price is unknown. It is doubtful whether this book will be made available in Australia, but could doubtless be obtained direct or ordered through local technical booksellers. (J.R.)

★ ★ ★

"ADVANCED MAGNETISM AND ELECTROMAGNETISM," edited by A. Schure, published J. F. Rider Publisher, Inc., N.Y. Soft cover, 5½ x 8¼in, 104 pages.

Written primarily for the advanced student and engineer, this book begins with a chapter concerned with the basic properties of the magnetic field and the various laws governing motion of charged bodies, forces on conductors and simple motor theory.

A chapter then follows which deals with electromagnetism and its effect on circuits in the guise of inductance, while another chapter shows the application of Lenz's Law to inductance behaviour, and discusses the properties of inductances in general.

A further chapter explains about Ferromagnetism, and enunciates the molecular and domain theories of magnetism. Hysteresis and the Curie-Weiss Law concerning temperature effects are also dealt with briefly. The concept of magnetic poles and forces is introduced in a small chapter, and equations involved in magnetic circuits are developed.

The final section of the book explains various applications of magnetic principles in technology. Mentioned are eddy-current brakes, transformers, the mass spectrograph, cyclotrons and the betatron.

Our copy of the book came direct from the publishers, but copies should be available locally in due course. (J.R.)

★ ★ ★

"MAGNETIC AND ELECTRICAL FUNDAMENTALS," by Dr Alexander Efron. Rider Basic Science Series. Soft cover, 132 pages, 5½ x 8¼in. Includes circuits, diagrams and photographs.

True to the title, this book is devoted to the fundamentals of magnetism and electricity. Initial chapters are concerned with basic concepts of magneto- and electro-statics, and the laws concerning flux density and forces on poles and charges enunciated.

Further chapters deal with electromagnetic principles from a physics viewpoint and various causes of potential difference or "charge displacement" discussed. Thermo-electric, photo-electric and plezo-electric effects are all explained. The final chapter introduces fundamental circuit theory, measuring instruments and the various International standards of voltage, resistance, etc.

The book appears to be very suitable as a textbook for senior years in High school physics, as it appears to be much more up-to-date than books presently used for this purpose. Our copy was from the publishers, J. F. Rider Publisher, Inc., New York, but the b will no doubt be available locally in due course. (J.R.)

★ ★ ★

"R.C.A. RECEIVING TUBE MANUAL," R.C.A. Technical Series RC-19. Soft covers, 5½ x 8¼in. 384 pages. Contains data tables, diagrams and circuits.

Intended as a data manual on all valves of the American type, this latest edition of the R.C.A. Tube Manual is ideal as a bench-side valve book in both construction and servicing fields. Average characteristics curves are given for all recent valves, and older valves, used principally for replacements, are included briefly, giving maximum ratings and socket connections.

As in the previous issues of this manual, the first section of the book is devoted to an explanation of valve operation and electronic circuits. The major section, naturally, is devoted to valve data, and all normal American valve types are listed, including television picture tubes for both monochrome and colour.

Our copy of the book from the Australian representatives of the firm, Amalgamated Wireless Valve Co. Pty. Ltd. The price is 8/ post free. (J.R.)

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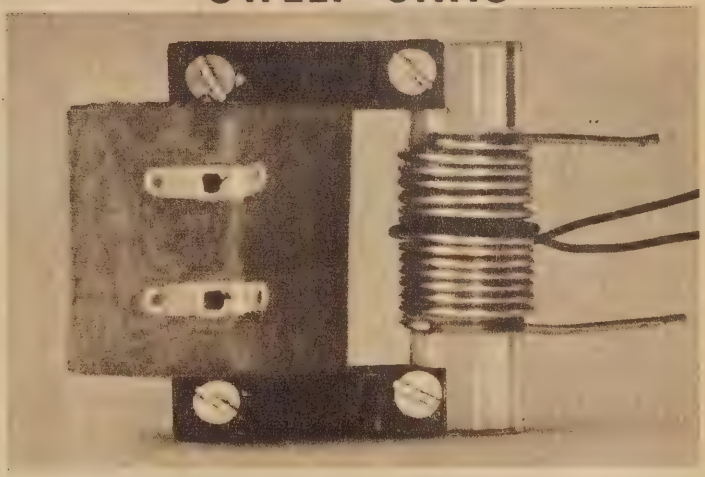

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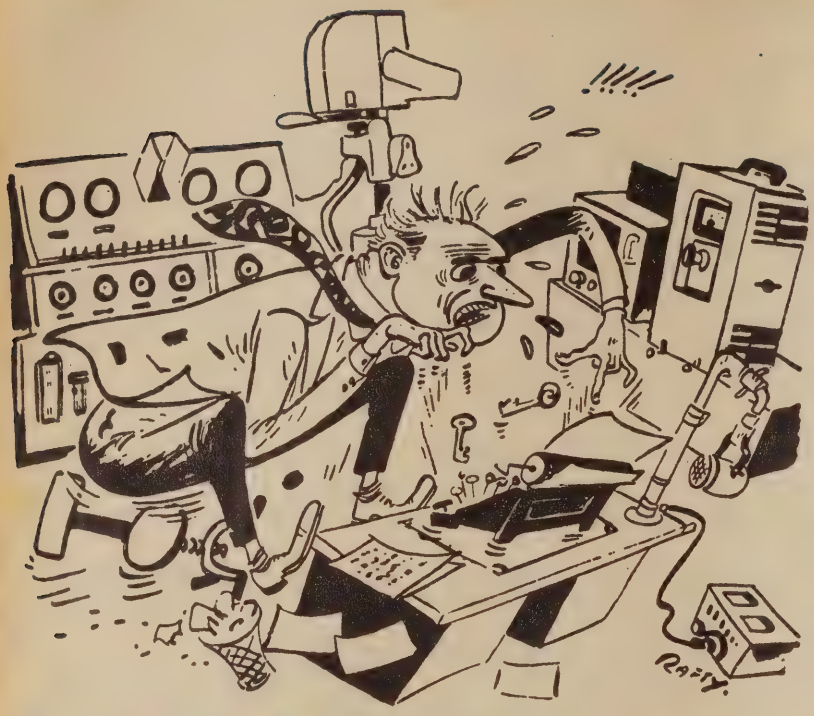


Let's Buy An Argument

A few pars in the "Answer Tom" page, elsewhere in this issue, set me thinking about the earth symbol and all that it stands for. I couldn't help but feel that it's one of the most widely used symbols, yet one of the least precise. No wonder beginners find it confusing at times!

by Neville Williams

BASICALLY, the earth symbol in a circuit should indicate that the particular wire or component is returned to physical earth—the thing we wa'k on. When the thing is thus "earthed," we assume that it has zero potential.

There is sound reasoning behind this last assumption. Though the conductivity of the ground varies enormously from one situation to another, it is nowhere such a good insulator that electric charges can accumulate spontaneously in one place and stay there.

UNI-POTENTIAL MASS

They are soon dispersed so that, for all practical purposes, the earth can be regarded as a huge, uni-potential mass. It might be regarded, further, as a limitless reservoir of electrons.

Some can be artificially diverted from the earth into a body insulated from it or vice versa, but no such artificial diversion has any significant influence on the earth itself.

It is like adding to or taking water from the ocean with a bucket. The bucket may be variously full or empty—and that is important to the wielder—but the ocean remains completely unaffected, as far as he is concerned.

When electrons are diverted from earth into a separate body or vice versa, we don't consider what has happened to the earth. For our purposes, nothing has happened.

We simply say that the body in question has been given a negative or positive charge or potential, as the case may be.

If the charged body is subsequently connected to earth, the surplus electrons immediately flow from it into the mass of the earth; if the charge is the opposite polarity, the earth supplies the deficit of electrons and, in so doing, is not significantly the richer or the poorer.

When a body is electrically connected to earth, therefore, we may tacitly assume that it has neither a surplus nor a deficit of electrons, nor can it acquire such. It is an earth or zero potential.

But don't let our assumptions be too tacit. There are difficulties in sight.

It is taken for granted that the earth provides a very low resistance path between regions on its surfaces, not so much by reason of good conductivity but the enormous cross-section of the conducting path. The only trouble is that our means of making contact with the earth's bulk are not always themselves quite so enormous.

TO WATER-PIPE

In a closely settled area, things that need to be earthed can be connected to a water pipe, in the knowledge that the said metallic pipe will connect to countless other pipes snaking for miles through the ground.

But a countryman has to be content with soldering a wire to a drum buried in the ground; or to a pipe driven down as far as his sledgehammer and muscle will force it. But, at best, its contact with the mass of the earth is not nearly so intimate.

I have heard of cases where electrical contractors have had the greatest difficulty in establishing adequate contact with earth, for example to satisfy the requirements of electricity supply authorities.

So you see, mere contact with the earth doesn't necessarily provide a satisfactory "earth." Or, to put it another way, we can have good earths, bad earths and medium earths!

Then again, an "earth" can be a bad earth for one purpose but a satisfactory earth for another.

DC RESISTANCE

Initially, it's a matter of the resistance between the pipe (or the thing we've contrived as an "earth") and the vast body of the earth itself. Secondly, it's a matter of whether this amount of resistance is important to what we are trying to achieve.

Power authorities specify, in some areas, that the resistance between their active line and the customer's "earth" must be so low that the short-circuit current between them will blow a certain rating of fuse.

If it won't, they reason that a series of mishaps in an appliance connection could raise the body of that appliance, together with the whole of the customer's

"earth" system so far above earth potential proper, that a dangerous situation could be created.

But, then, a good earth, from an electricity supplier's point of view, isn't nearly good enough, say, for someone erecting an aerial for a broadcast station. They are interested in setting up electric and magnetic fields between the mast and the surrounding earth. A poor "earth," for them, would mean low efficiency, lowered radiation and reduced signal coverage.

So they choose flat or even swampy environs for the mast and, not content, bury a veritable carpet of radial wires in the soil!

LESS OF A PROBLEM

Fortunately, the broadcast listener doesn't have to go to such lengths to receive the signal. In fact, for the purpose, a quite effective earth to go with his aerial system may fall far short of the requirements of either transmission engineers or electricity supply authorities.

Why?

Because the current in his aerial system and its impedance at the signal frequency is so high that a bit of resistance in the earth circuit doesn't make much difference to the end result.

If you have any doubts that resistance is purely relative, let me quote an everyday example. In your hand torch (Americans prefer to call them flashlamps), a very small amount of resistance can dim the globe or even make it fail to light altogether. Yet you can wire 10,000-ohm suppressors in the spark plug leads of your car and it will run just as well as before.

At this point one can imagine a smile of comprehension dawning on the face of a newcomer to radio:—

"Well, that all makes sense. Electrons with a place to go or a place to come from! Good earths, bad earths, indifferent earths — by reason of resistance and current.

"But, tell me, why are aerials nearly always shown as being earthed in radio circuits?"

"Oh no, they're not!"

"Oh yes, they are!"

In a sense the questioner is right. Aerials are shown as earthed via the receiver's aerial terminal, the aerial coil primary, the chassis and thence the earth wire.

EARTHED FOR DC

They're certainly earthed as far as DC is concerned. An ohmmeter between aerial and earth would show only the very small resistance of the aerial coil primary winding. Therefore any electrical charge on the aerial wire would be rapidly dispersed.

But, when excited by an incoming signal, the aerial potential oscillates rapidly positive and negative with respect to earth potential — at the frequency of the incoming signal, in fact!

This produces a corresponding rushing to-and-fro of electrons in the earth return circuit: To the aerial when it is positive; away from the aerial when it is negative.

This cyclic rushing to and fro of electrons is really an oscillating high frequency current through the aerial coil primary winding. An oscillating magnetic field is produced, whose constantly

"BRAIN" CIRCUIT IS TOO COMPLEX

Dear Sir,

I read with much interest Mr Molesworth's article in your February issue. We all realise I think that the electrical "brain" described by Mr Molesworth is of no practical value (except perhaps as a demonstration unit). However, the logic he discussed was very interesting.

I find Mr Molesworth's circuits are quite needlessly complex, however. First let me take his premise-making circuit. In this Mr Molesworth has used no less than four relays, none of which is necessary.

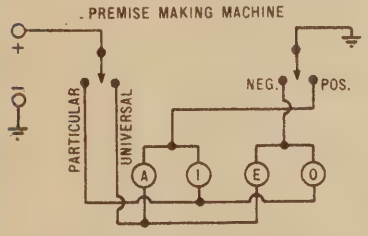
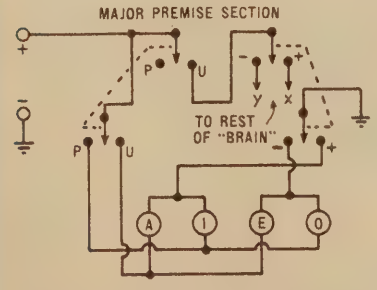


Figure 1 accomplishes the task of lighting a bulb to correspond to a particular configuration of the two 2-position switches. There are four such configurations, therefore there are four bulbs as Mr Molesworth says, the A, I, E, O bulbs.

Now let us consider the electrical "brain." Let us start with the major premise section. This section has two wires going from it to the rest of the "brain" (neglecting the positive battery lead). This section may be simplified to the circuit of figure 2.



In my opinion the A, I, E, O lights in the major premise circuit are not necessary (think of the hook-up wire saved). If they are desired, then two 2-pole 2-position switches will be required.

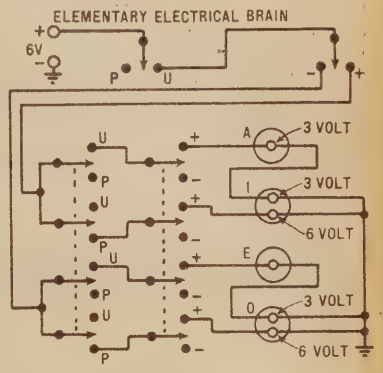
For the next section of the brain I am forced to a little more complication. However, instead of six relays I have used only two wavechange switches (of which most experimenters would probably have a number on hand in the junk box).

The circuit for the next section of the "brain" is then as follows: In Mr Molesworth's design, the A conclusion bulb is never alight by itself but always in conjunction with the I bulb. This is perfectly correct because, if "all X are Y," then "some X are Y" obviously.

However, the I bulb can be lit by itself. The same, of course, applies to the E, O bulbs. If "no X are Y" then "some X are not Y." If the bulbs are to glow at normal brilliance (and in Mr Molesworth's circuit they will not) a modification is necessary. The I and O bulbs must be double bulbs.

If a 6-volt battery is used, then one of these will be a 3-volt and one a 6-volt bulb. The A and E bulbs will be 3 volts. This modification is shown in my circuit.

The completed "brain" uses two wave-change switches, a one-pole two-position switch and an on-off switch, plus bulbs.



Several interesting logical truths will become apparent from the circuit. For example, no conclusion can be drawn unless the major premise is a universal one.

This is shown by the fact that no battery voltage is fed into the circuit if the first switch is in the particular position. As Mr Molesworth pointed out, one of the premises must be universal and this must be made the major premise.

However, Mr Molesworth knows more about logic than I, but I hope my simplified circuit will be of interest. A push button in the battery lead would be useful.

I would like to say how much I enjoyed reading the "Switchcraft" article and the two by Mr Molesworth. I am looking forward to seeing more along these lines.

I am,
Yours faithfully,
Noel Bignell.

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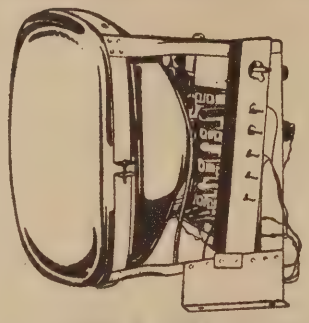

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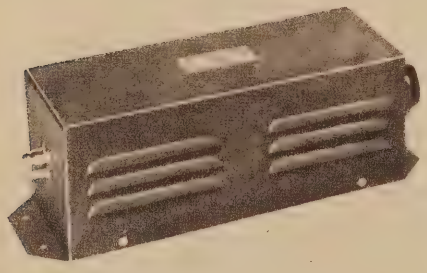

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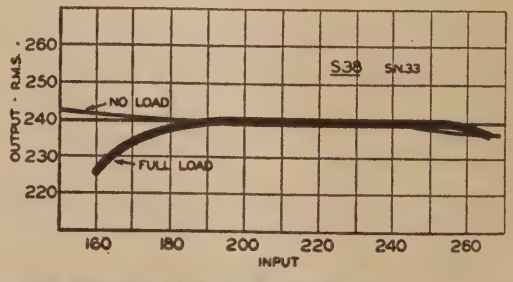

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moving lines of force cut the turns of the secondary winding.

And we find ourselves with a signal in the secondary winding, ready to pass on to the first amplifier grid. So the passage of current in the aerial-earth circuit is made to serve a very important purpose.

But it isn't just a simple earth circuit. The turns of wire on the aerial primary winding represent a certain inductance and therefore present a certain inductive reactance at the signal frequency, complicated by any additional impedance reflected to it from the secondary.

So while the aerial is reasonably earthed as far as DC is concerned, it is separated from earth by the impedance of the aerial primary winding at whatever frequency we are concerned with!

A CONUNDRUM

So we can make up a conundrum:

When is something not earthed when it is earthed?

Answer: When it's grounded through an inductor.

But there's another point that comes out of all this: A conventional non-resonant receiver aerial only works in the way it does when the charges imposed on it can flow to and from earth, as described.

That is why battery sets and crystal sets seem to rely so heavily on an earth wire, as well as an aerial. But here one is in danger of being deafened by a chorus of protests.

"What about the counterpoise idea?"

"Why don't mains receivers need an earth?"

"What about television sets?"

One at a time, gentlemen ,please!

As far as the incoming radio signal is concerned, mains operated receivers are, in fact, fairly effectively earthed. To be sure, an ohmmeter may show no readable path between the chassis and physical earth, but there is a path for signals, just the same.

It is via the stray capacitance between the chassis and the transformer primary winding, which is connected in turn to the mains. One side of the mains is normally earthed but, in any case, the mains in bulk have a large capacitance to earth.

The point about a capacitance is that it can pass alternating signals, therefore radio frequency signals. These can move to and fro between aerial and earth, through a path involving the primary of the aerial coil, the stray capacitances in the power transformer and wiring thereto, the mains wiring and thence to earth.

VARY IN VOLUME

This, by the way, is a reason why some receivers vary in volume when light and power switches in the house are operated. The introduction or deletion of wiring by these switches modifies the signal path from aerial to earth.

And from this, we can deduce our next confusing little fact: When there is an adequate capacitive path between the chassis of a receiver and earth, it may be considered as being earthed for signal frequencies, even though it is not earthed as far as DC is concerned.

Conundrum No. 2: When is something earthed when it is not earthed?

Answer No. 2: When it is grounded by capacitance.

The idea of a counterpoise is to have a second wire, often underneath the aerial and close to ground to which the lower end of the aerial primary winding is connected.

The field from the transmitter creates a potential difference between the aerial and counterpoise, inducing current through the primary winding, as aforesaid.

But then nobody I know uses a counterpoise, unless the earth wire or mains wiring is sufficiently convolute to act in this fashion.

As for battery portables, these rely on an entirely different mode of signal pickup. They use a loop or loopstick aerial, which is tuned to the frequency of the signal which it is desired to receive.

Being resonant, they will produce a significant signal voltage between their ends for a relatively small amount of energy coupled into them from the magnetic field of the transmitter. They do not rely on the electric field, as does a conventional aerial, involving earth.

In remote areas, the signal pickup of the loop alone may be often insufficient and provision is made to connect an external aerial and earth. And here we come right back to our starting point. A modest external aerial, alone, doesn't help a great deal, because it relies on the electric field and it has no return path.

But, connect an earth as well, and hear the set go!

(To Page 152)

WHAT'S THIS KITTEN ABOUT CATS?

Mr R. Hartkopf's comment on my introductory article on "Logic Machines" makes very entertaining reading, but it contributes nothing to the subject under discussion.

Mr Hartkopf tells an amusing story about a man who reasoned —illogically—that a small object cannot pass through a large hole. From this he concludes that the designer of a logical machine must act in an equally silly fashion.

Not so. If a man makes silly blunders in using a slide-rule, or uses a sledgehammer to swat a mosquito, we do not blame the tool; we blame the man who failed to understand the tool and accordingly used it wrongly.

Logic is a tool which enables us—if we use it correctly—to deduce valid conclusions from certain premises. If we start off with a silly premise (that a kitten cannot pass through a cat-sized hole) then logically we must end up with a silly conclusion (that we must cut out special kitten-sized holes).

The fault, dear Brutus, lies not in the logic, but in ourselves. It is up to us to check the data which we feed into our machine: the machine operates—logically—on the data we provide. If we get ridiculous answers, we have only ourselves to blame for feeding in ridiculous information. (This point was made very firmly in the articles.)

USE "COMMONSENSE"

The sinew of Mr Hartkopf's comment is that we must use "commonsense" in selecting the functions to build into our machine. A designer is perfectly free to build whatever functions (switch-choices) he pleases into a machine. He is also perfectly free to defend his choices as being "commonsense" ones.

Unfortunately what appears to be "commonsense" to one operator often appears to be in need of proof by other operators.

For this reason alone, it is at least in accordance with sound design principles to leave out one's own prejudices and put in what is quite independent of (and therefore uninfluenced by) the designer—in this case, the impersonal relationships of logic, which are not in the designer's mind, but out there in the world.

In considering the world, for example, there are two possibilities—either it is flat, or it is not flat. (The latter term includes, of course, all shapes other than flat —round, oblately spherical, hexagonal, etc.)

If Mr Hartkopf wishes to argue that it is "obvious" that the world cannot be flat, and it would therefore be "commonsense" to leave this possibility out, he straightaway limits his machine to operating only along those lines which reflect his "commonsense" views of the universe.

MACHINE IS LIMITED

Even if every one of Mr Hartkopf's "commonsense" views happens to be correct (which it is "commonsense" to doubt), his purely autobiographical machine cannot carry out a number of very important and very useful logical operations.

For example, it cannot be used for "what if?" operations, since there is no way of setting up untested hypotheses or counterfactual propositions (who wants to waste time with Rieman and Lobachevsky, anyway?), and it cannot be used to discover that given conclusions are based upon, and therefore disproven by, false premises (who wants to be proven wrong, anyway?).

My main objection to Mr Hartkopf's comment, however, is his rather unfair linking of Aristotle, the founder of the science of logic, and the man with the cats.

This is analogous to linking Einstein with the milkman who made mistakes in the bill, and drawing the conclusion that mathematics is unsound.

That bloke with the cats would have saved himself a lot of carpentry if he had ever bothered to read Aristotle.

Vol Molesworth, M.A.
VK2VO.

(The title for the letter was suggested by the Author. — EDITOR.)

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Associated Transistor : 2N408 { 2N408 / 2N408

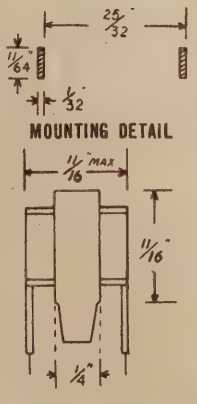
Impedance: —5800 ohm: 3000c.t.

Ratio :

Primary Inductance :
1) Sec. o/c 1v 50c/s + 1.5ma D.C. = 4.7H.
1) Sec. s/c 1000 c/s = 20 mh.

Resistances :
Primary = 300 ohm ± 10%
Secondary = 300 ohm ± 10%

Note :
Secondary winding is Bifilar.



Transistor Output

Part No. 38158A

Associated : Class B—2N408

Transistor : 9v Battery

Impedance : —540 C.T. : 15 ohm.

Ratio :

Primary Inductance :
1) Sec. o/c 1v 50c/s = 1.2H
2) Sec. s/c 1000 c/s = 2.5 mh.

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Primary = 50 ohm ± 10%
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TRADE REVIEWS AND RELEASES

STEREO RECORD CHANGER, AUTO/MANUAL PLAYER

The newly released Dual 1006 Record Changer is a precision unit with a number of novel features. Designed to handle both stereo and monaural records it is built to the same high standard which we have learned to associate with the name of Dual.

The Dual changer is a neatly finished well made unit. The speed control selector is on the left of the baseboard, and the "start," "stop," and "repeat" buttons on the right under the pickup. The stylus weight gauge is behind these buttons.

THE 1006 is a fully automatic record changer. However, it is very versatile and also may be used as an automatic record player, a manual record player, or a changer for records with the large centre hole by means of a special centre spindle, available as an extra.

As a record changer it will play up to 10 records of mixed diameters, which are placed on a spindle provided for the purpose. Records are released on to the turntable by a mechanism within the spindle, the selection of record diameter being performed by the pickup.

The latter action is quite ingenious and is common to both the changer and the automatic record player functions.

On pressing the start button, the pick-up arm moves over to the centre of the record, and then drops to the surface, contact with the record being made only by means of a pair of roller wheels. The arm then moves outward to the edge of the disc with the rollers in contact all the way.

As the edge of the disc is reached, one roller drops off the disc, checking the outward travel of the arm. The arm is then lifted, the rollers retracted and the arm lowered again on to the record, the stylus being placed gently in the groove. At the end of the disc, whether the unit is set as a changer, automatic or manual player, the arm is returned to its stand.

The cartridge, a high quality crystal, is a type CDS 420/4. Its recommended tracking weight is five to six grammes. A unique feature of the unit is a built-in stylus pressure gauge giving readings from two to 10 grammes. Stylus pressure may be adjusted by means of a screw located at the base of the arm pivot.

A switch on the base plate parallels each section of the cartridge for monaural operation.

PERFORMANCE

Checked in our workshop the unit behaved very well. On a listening test the pickup compared very favourably with any of the crystal types we have heard to date. The frequency range claimed for the cartridge is 20 c/s to 16 Kc. While we did not have an opportunity to double-check this, the response sounded smooth on listening, separation good and there was no apparent wow or rumble.

The sample unit supplied was equipped with a heavy turntable which was driven by a four-pole induction type motor. The turntable is rim-driven and coupled to the motor through rubber-tyred drive wheels and an idler wheel. A separate drive wheel is provided for each speed.

Retail price of the unit is given as £39/12/. Further details may be obtained from the distributor, Messrs. Fred. A. Falk and Co. Pty. Ltd., 28 King Street, Rockdale, N.S.W.

TRANSFORMERS FROM FERGUSONS

Ferguson Transformers Pty. Ltd., announce two new step-down transformers for use by the radio and electrical industry. Each should find a wide application in its respective field.

ONE is a soldering iron transformer, primarily intended to operate nominal six-volt soldering irons, such as used extensively on modern miniaturised equipment. (See picture.)

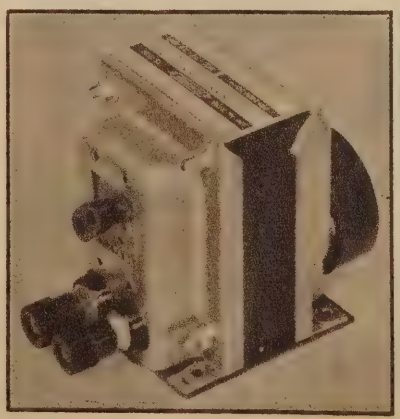
The primary is designed for 240-volt, 50 cps operation, but may be used on mains rated between 230 and 250 volts. The secondary has three taps at 5, 6 and 7 volts, and has a rating of 20 VA continuous. Selection of the required voltage is by means of three-position plug and socket.

The other model is a general purpose step-down transformer with similar primary specifications, but designed to deliver 4, 8 and 12 volts from the secondary at a continuous rating of 12 VA. The tappings are brought out to three separate terminals.

This unit is suitable for low voltage decorative lighting systems, signal and indicator lamps, bell and buzzer circuits and similar applications.

Both transformers are vertical mounting types, fitted with approved bakelite primary connectors, finished with black lacquered laminations and grey hammertone covers.

Price and other details may be obtained from the makers, Ferguson Transformers Pty. Ltd., 411 Victoria Ave, Chatswood, N.S.W.



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TYPE 213
50 ohms input to Grid or High Impedance output.
TYPE 214
Grid input to Grid or High Impedance output.

- *Provides greater sensitivity without tonal loss or distortion.*
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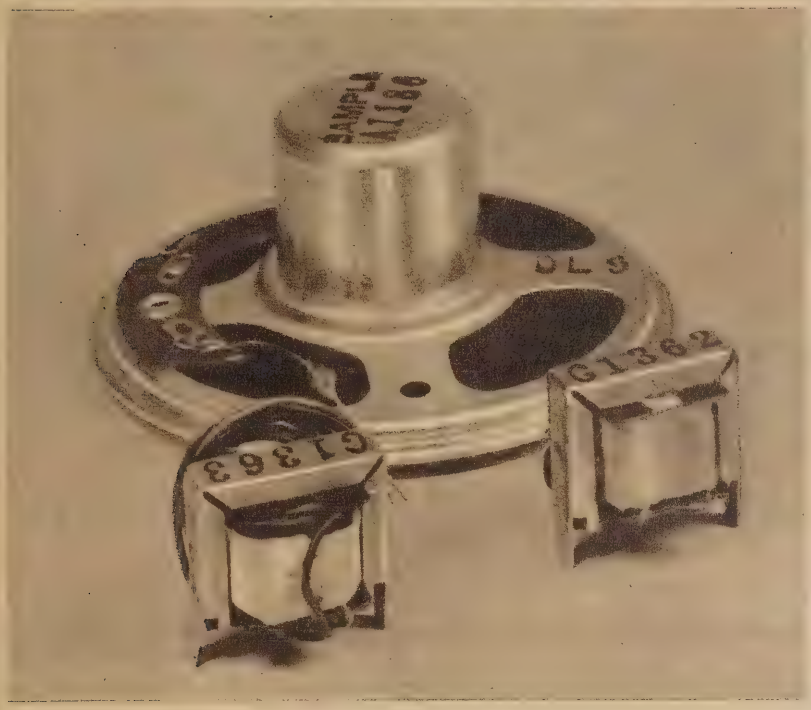
MINIATURE PARTS FROM MSP



Designed to meet the growing demand for miniature transistor portables, a miniature speaker and two miniature audio transformers have recently been developed by Manufacturers Special Products. These should be welcomed by both manufacturers and home builders.

THE speaker is designated as type 275JA-15. It is 2¾in model, with an overall depth of 1 3/16in. As can be seen from the picture the cone housing is quite flat, and the cone is only slightly less so. This is in keeping with the present trend of transistor set construction and makes possible a very compact design.

The voice coil impedance is 15 ohms and the power handling capacity is given as 500 mW, with peaks to 750 mW. The cone resonance is 320 cps, plus or minus 30 cps, and the top limit is 5,000 cps. This latter has been deliberately restricted to minimise noise which may occur in some transistor circuits.

Special care has been taken in the design of the dust cover in the centre of the cone, experience having shown that extremely small particles of sand can find their way into the gap unless this is sufficiently fine.

The two transformers are transistor-driver and output types respectively. Both are the same size, measuring 11/16in high, 51/64in long and 11/16in wide. Mounting is by means of lugs inserted in suitable chassis or baseboard slots.

The driver transformer has an impedance ratio of 5,800 ohms (primary) to 3,000 ohms (centre tapped secondary) and is intended to couple a type 2N408 transistor functioning as a driver stage to a pair of 2N408s operating in class B.

The output transformer is a companion unit designed to couple the 2N408s to the loudspeaker. It has an impedance ratio of 540 ohms (primary, collector to collector) to 15 ohms (secondary).

Connection is by means of colour-coded flexible leads for wiring directly into circuit, and the centre-tapped winding in each case is bifilar wound. Both units are neat, well-made components, which should supply a very definite need on the local market. Other types, having similar physical characteristics, but differing electrically, also are available from this company.

Any information concerning these, or additional information, price, etc., concerning the units described, may be obtained from the makers, Manufacturers Special Products, 47 York Street, Sydney.

FESTIVAL AGENTS FOR REX RECORDS

FESTIVAL Records Pty. Ltd. recently announced that they have been appointed agents for Rex Records Pty. Ltd.

Both firms regard this as a major step forward in the Australian recording world, since the new label is essentially Australian and the company is dedicated to the promotion of Australian artists.

In particular, it is intended to give these records world-wide distribution, so that Australian artists will be able to challenge the world's markets.

"SAKURA" TR4H TESTER

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With leather carrying case to suit,

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MULTI METER TESTERS

AC-DC VOLTS — OHMS — M.AMPS. — CAPACITY — DECIBELS.

MODEL No.	SENSITIVITY AC	SENSITIVITY DC	RETAIL PRICE Incl. Tax £ s. d.	REDUCED TO YOUR COST £ s. d.
	Ohms per Volt			
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320	"	"	15 10 0	10 7 6
MG310	"	"	15 0 0	10 2 6
TP5S	"	"	11 5 0	7 10 0
M.D.	10,000	10,000	8 10 0	5 16 3
MTIAS	10,000	5,000	14 12 6	9 15 3
MT2A5	4,000	2,000	10 19 6	7 6 3
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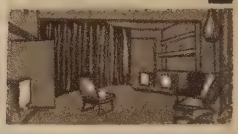

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Wharfedale
LEAK

QUOTATIONS TO THE TRADE ON REQUEST

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ROLA 12PX "STEREO MASTER"

Recently announced by the Rola company is their model 12PX "Stereo Master," a wide range speaker in the medium price range. The speaker has been specifically designed for use in stereo systems, where the total cost of two high quality speakers otherwise would present a problem.

THE 12PX is a multiple cone type, similar in general style to the 12UX, and having similar response and other characteristics. However, by careful design it has been possible to reduce the price substantially without sacrificing any worthwhile features.

For example, the peak power rating, while somewhat reduced, is still given as 20 watts, and it is difficult to imagine any domestic set-up which would even approach this requirement. Supporting this is the fact that efficiency does not appear to be sacrificed to any large degree, the simple stereo system elsewhere in this issue being able to produce more volume from them than could possibly be required in an ordinary room.

Frequency response is given as 45 cps to 12 Kc, with a cone resonance of 50 cps. This range is only slightly less than that of the 12UX, and should be perfectly adequate for all but the most expensive and specialised equipment.

Another claim by the makers, and presumably due to the relatively low cone resonance, is that a vented enclosure is not essential for good bass response, very good results being possible with the usual open back cabinet, where this is all that can be provided.

A pair of these tried in our own workshop put up a very impressive performance, and there seems no doubt that the makers' claims are fully substantiated.

Not the least attractive feature is the price. At £15/5/ retail this is only slightly more than half the cost of a 12UX, or a stereo pair for little more than the cost of a single speaker. We imagine this will prove to be a very popular model.

TWO NOVEL RADIO SLIDE RULES

TWO inexpensive slide rules recently forwarded to us for inspection should appeal to all radio workers and experimenters who regularly carry out calculations concerning resistance, capacitance and inductance.

One, produced by the Ohmite Manufacturing Co. of Illinois, U.S.A., is devoted to resistance calculations, but includes the A, B, C and D scales of a conventional slide rule as an added feature.

All normal calculations involving volts, ohms, amps and watts may be made with a single setting of the slide, regardless of which factor is unknown.

In addition, a set of parallel resistance scales enable the calculation of either the equivalent resistance produced by any two values in parallel, or an almost infinite number of combinations which will give a selected equivalent resistance.

The second rule, produced by Shure Brothers Inc., Illinois, cover most problems likely to be encountered involving inductive reactance, capacitive reactance and resonance. Calculation of "Q" also is possible. As with the resistance rule, it should prove a great time saver.

Both rules are made from stout, good quality card and, with care, should give many years of service. Prices are very attractive, the resistance rule being 6/9 and the reactance rule 16/, postage included in both cases.

Our samples were from McGill's Authorised Newsagency, 183 Elizabeth Street, Melbourne, C1, Victoria, and intending purchasers should write direct to this firm.

NEW "BT" RESISTOR

International Resistance Co. (Aust.) Pty., Ltd., announce a new type of construction for the well-known "BT" moulded resistors in the popular half, one and two-watt ranges. The new resistor is the result of several years' research both locally and overseas.

Its main feature is a new resistance element capable of stable operation at ambient temperatures as high as 70 degrees C. This new element has, in fact, been used in all locally made BT resistors for several months and extensive tests have proved its superiority.

STEREO TAPE HEADS !! NOW AVAILABLE !!

These Heads consist of a matched pair of stacked half track record-play elements within the one standard case, the same case as the Ultron series.

Pre-aligned, in-line gaps of extreme accuracy (.00016 in. gap spacers, alignment is so exact that the outputs of both tracks are fully in phase up to 20 kc.)

Overall separation is better than—45dB. Playback separation—53dB.

TWO INCOMPARABLE MODELS:—

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Type HD extreme range, each track same as Ultron 15HT.

THESE HEADS ARE BUILT TO THE SAME HIGH STANDARDS THAT HAVE MADE L.B. PRODUCTS TAPE HEADS LEADERS IN THE FIELD FOR A DECADE

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Ultron 15, 15T, 15L (Record-play high impedance, extended range. .00016in gap) **£9/13/6**

Ultron 15H, 15HT, 15HL (Medium impedance extreme range. .00016in gap) .. **£9/13/6**

Ultron 15S, 15ST, 15SL (High efficiency record .00025in gap) **£9/13/6**

HE2, HE2T (Record-play, commercial quality .0002in gap) **£6/3/**

EU, EUT, EUL (High efficiency erase) **£5/7/**

H4 (Record-play) and EH4 (Erase) Miniatures .0002in gap **£5/2/**

Note: "T" denotes upper half track, "L" lower half track, all others full track (except H4 and EH4, which are half track).

SEND 4/ Postal Note for a copy of MAGNETIC TAPE HEADS, containing full details of all heads, including Stereo, High Fidelity Circuits, hints to builders, etc. A FREE COPY WITH EVERY HEAD. Copies also at Technical Book Co., Swanston Street, Melbourne.

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A. G. Healing Ltd., 376-400 King William St., ADELAIDE.
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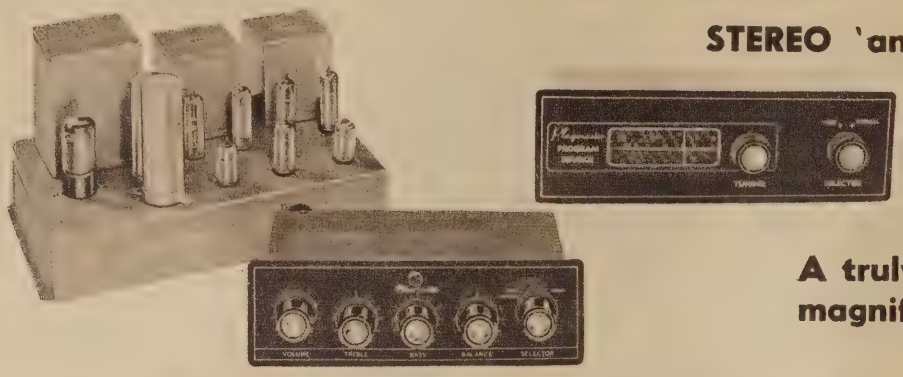

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Dear Sirs,
Please send me full details of the following:
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☐ Playmaster Hi-Fi ☐ 110 deg. TV Kit

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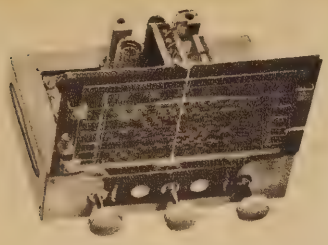

Playmaster Dual Wave Tuner. Available with power supply and tuning indicator.

Playmaster control unit boxes, ready drilled complete with front panels and brackets. High quality hammertone finish. Full range of Playmaster amplifier and tuner chassis also available.

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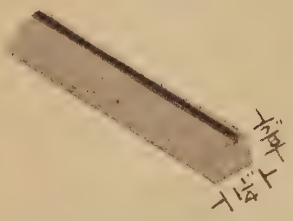
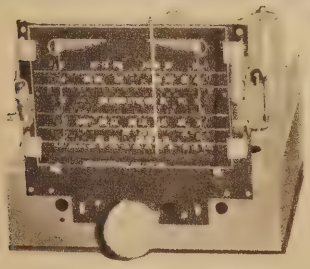


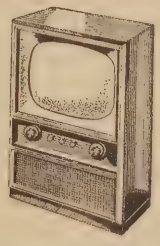
High-grade timber moulding, complete with gold coloured metal insert. Same type as used on highest quality TV cabinets.

Complete kits plus ALL accessories and spares for the "R, TV and H" TV Sets and Playmaster Hi-fi equipment.

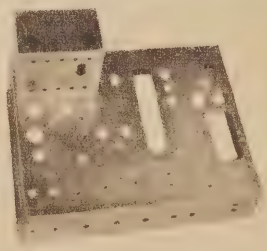
Anodised metal labels to suit various Playmaster amplifiers, control units, and program source. Mono' labels, maroon background with silver lettering. Stereo coffee brown and gold. Beautiful knobs with gold metal centres to match.



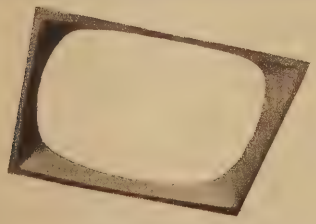
Some very fine hi-fi tuners are included in the Playmaster range. See Playmaster specification sheets for full details.



Timber kits to construct the 110 degree TV cabinet. Everything precision cut. All parts included, glass, mask, beading, gold insert, speaker grille, etc.



TV chassis, specially made for "R.T.V. and H." 110 degree circuit. Cadmium plated, and then passivated to avoid fingermarks. Complete with E.H.T. box, and all holes drilled.



The very best plastic TV masks as used on the finest commercial sets. 21in and 17in. Also available metal reducing mask, hammertone finish to enable 17in set to fit in 21in cabinet.

Q plus Mark V I.F. strip, ready wired and aligned for the 110 degree TV set. If purchased with the Q plus tuner, we will supply them matched.
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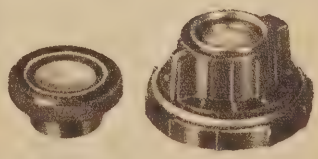

Set of 5 high-quality TV knobs for 110 degree TV set. In coffee brown or ivory, with attractive gold coloured, trim station numbers on tuning knob.

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OFF THE RECORD — NEWS & REVIEWS

There is currently a good deal of argument overseas on the subject of mono-stereo compatability. Like most arguments, it seems to be characterised by a degree of overstatement, which some may find disturbing.

by Neville Williams

IN general, the arguments spring from two very practical situations:

(1) Someone decides that it is time he bought a complete stereo system or converted his present system to same, by doubling up. He is concerned, however, whether the new system will play effectively his present, cherished library of mono LP's. Or—

(2) Someone has decided that he will instal a stereo equipment later, when funds permit. In the meantime, it seems false economy to buy more standard LP records, when he could have the stereo versions for the same money. Would it be wise, therefore, to instal a stereo pickup, connect the two sections in parallel and use it to feed his present single amplifier? By so doing, he can build up a library of stereo records.

In answer to his questions, he is likely to run up against two strongly held sets of opinions.

TWO OPINIONS

One says: A stereo pickup will play your mono LPs as effectively as ever, whether feeding a single or a double channel. What you propose to do is just good commonsense.

A second weight of opinion says No! Mono records, particularly the older ones, don't sound well with a stereo pickup. Provide a stereo system for stereo records but keep your mono pickup in service for the standard LPs. Or, while you have only a single channel, buy only mono records!

Which leaves the original inquirer pretty much on the horns of a dilemma.

The objectors appear to be basing their opinions on three distinctly different premises.

The first and most obvious has to do with groove shape and stylus fit.

When the microgroove standard was first introduced, it seemed a daring step to bring the stylus tip radius down to 1-mil. While such a fine point promised (and gave) fewer tracing difficulties, there were plenty of prophets of doom who maintained that the pressures and stresses would lead to very rapid record and stylus wear.

The earliest microgroove pickups were indeed a motley group but, such has been the progress since, that records and stylus wear are no longer any great problem. In fact, with the introduction of stereo, a new standard was considered entirely practical, namely a stylus tip radius of 0.5-mil.

Use of this standard suggested the likelihood that styli intended for stereo playing would not fit the grooves of existing LPs; they would "skate" on the rounded bottom and produce a "rattling" kind of distortion.

In the face of this, a compromise has been suggested and is widely used in stereo pickups, namely a stylus with a tip radius of 0.7-mil. The idea is that it should be fine enough to trace stereo discs and large enough to fit standard LP grooves except, perhaps, those which by accident or design have an unusually rounded bottom.

But, like all compromises, it has been freely criticised. "Too big for one job, too fine for the other . . . etc."

Please pardon me if I seem like a doubter but I do wonder how precise some of these measurements are in practice. I wonder if the recording engineers have been as assiduous in checking their cutting styli for contour as some of the "discophiles" are in observing "official" figures.

And I wonder whether every 0.5-mil. stylus, with or without some wear, is exactly 0.5.

For what it means, one very large manufacturer is currently producing all standard styli to a tip radius of 0.6 mil., plus and minus 0.1 mil. This is considered a better technique in the long run than marketing separate sizes and having tolerances carry individual styli well below 0.5 mil. or well above 0.7 mil.

"HORRIBLE RATTLINGS"

Despite all this, however, there are references in overseas correspondence to the "horrible rattlings" made by stereo pickup styli in trying to trace a standard LP groove.

Let me say that the subject of "horrible rattlings" is not exactly a new one to the writer. Right back in the very early instalments of the "Let's Buy An Argument" series, we were occupied in pointing out the vagaries of stylus fit in the 78 r.p.m. records — even the test records then available.

We published curves to show variations in pickup behaviour which these vagaries could cause.

We devised top cut filters, etc., in an effort to obviate their worst audible effects.

But — the order of difficulties encountered in those days were far and away greater than any I've encountered with mono and stereo discs.

Maybe I've been lucky. Maybe various friends have been lucky. Maybe a lot of things, but the simple fact is that any monos that I have occasion to play, either new or out of the heap, seem to play fine—or fine enough for my purposes.

On the same subject, a local recording engineer expressed the opinion to me that the number of standard LPs which cannot be played with even a 0.5-mil. stylus forms a very small minority.

In the light of all this, talk about "horrible rattlings" appeals to me as extravagant and likely to give readers an entirely wrong appraisal of the position.

A compromise is not always necessary, of course. Some pickups can be obtained with plug-in heads—78, mono LP and stereo. In other cases, if one is prepared to do without 78, a turnover system can be arranged to provide for mono LP and stereo only.

But where one is not prepared for the extra cost of plug-in heads, or to sacrifice 78s, or to mount two pickups with switching on the one board, a balanced appraisal of the alternatives is essential.

A second major objection is that mono pickups have had the benefit of years of refinement and are better than the relatively immature stereo equivalents. Therefore, the best mono pickups are likely to perform better on standard LPs than the best stereo pickups, quite apart from any problems of stylus fit.

Along the same lines, the best mono cutters should be capable of making a more faithful recording than the best stereo cutters. Therefore, it is good practice to retain any high quality mono pickup to play mono recordings; further, unless a full stereo system is available, to continue to buy mono recordings.

To my mind, this line of reasoning finds a germ of truth and proceeds to build a whole edifice thereon.

It may be true that the best mono pickups are better than the best stereo pickups in terms of ultimate response and distortion. But it doesn't follow that a mono pickup which was the "best" in its day is better than a modern stereo equivalent.

It may be true that the best mono cutter is better in the same qualities than the best stereo equivalent. But is the difference a limiting factor? In a recent issue we quoted one of the world's top recording engineers as saying that, with the best cutters now available, the distortion limit is being set, as often as not, by the intervening tape medium.

LIKELY LEVEL?

In any case, it is necessary to remember the likely level of this distortion. Who is prepared to say that the distortion level in their speaker system alone will not be sufficient to blanket the difference between the best mono and the best stereo cutters?

In a few cases—and these will doubtless include some of the overseas writers—the user may have a magnificent line-up of the best of everything, with rural acuity and enthusiasm to match.

They may additionally be "distortion snoopers," gaining as much pleasure therefrom as listening to the end result!

But, however valid, their findings cannot automatically be scaled down to the kind of equipment so many of us have to use. And, in saying this, I'm not referring to the cheapest ancillary

equipment. I'm thinking of the intermediate quality speaker, which most of us still find expensive, together with the very best crystal pickups or the cheaper magnetics.

To argue about original cutter quality, on this basis, is rather fatuous.

What's more, I have the impression that some of the best stereo crystal pickups currently in use are better—not worse — in general characteristics than their mono antecedents including some of the less ambitious magnetics.

So let the prima donnas of playback argue as they will. But don't rush to the conclusion that their observations apply all along the line. They may not mean a thing in terms of the more average hi-fi enthusiast and his gear.

Last, but not least, there is a lot of argument of a more aesthetic nature and, as always, it is delightfully indefinite.

Perhaps I can reduce it to more practical terms, as follows: With a mono recording — or a mono system — the listener can have no genuine sense of direction as far as the sound is concerned. It all issues from the one apparent source.

By familiarity, he is able to recognise sounds of different characters and, by ordinary mental processes, concentrate on one or the other. His task can be made easier by the conductor and/or the recording engineer, by arranging that the soloist or instrumental group have some slight pre-eminence over the remaining sound sources at the appropriate times.

This can be done by initial arrangement of the instruments, by choice and placement of the microphone(s) and by manipulation of the faders in the recording console. In large measure, it boils down to a matter of amplitude and frequency response which becomes, in the terminology of the musically minded, "forward tone," "dominant," and so on.

RESPONSE, LEVEL

With a stereo system, perception of individual sounds is no longer just a matter of familiarity, frequency response and level. The vital sense of directivity is restored and the other attributes retreat somewhat in performance.

Now comes the 64-dollar question: If a stereo recording is made, which exploits this sense of direction to best advantage, is it not possible that it will simultaneously have retreated from the subtle use of amplitude as required for mono presentation?

If it is therefore played with a stereo pickup but through a mono channel, will it not sound needlessly "flat?"

Would it not be better to have an original mono version of the performance?

To this, I imagine the answers would be as varied as the faces in a railway carriage.

How much of the traditional mono technique is likely to have crept into individual stereo recordings? Where it has, there would be nothing to fear from the mono angle.

To what extent have recording engineers deliberately ignored possible mono requirements?

When mono copies are made, are they from an individually monitored mono tape, are they artificially compounded by blending stereo tapes or are they just a routine parallel copy of the two tracks?

My guess is that they could be all or any, depending on the companies and records involved. To assume any general rule governing all records would be presumptuous.

All this was given point by the recent announcement of so-called "compatible stereo" discs by the Deutsche Grammophon Gesellschaft (DGG).

They were accompanied by the suggestion that audio enthusiasts could purchase a stereo pickup, couple it to their mono amplifier and build up a library of compatible stereo records against the day when they could put in a complete stereo system.

Released without any technical explanations, it raised the obvious question of "what is compatible stereo?"

Some overseas writers speculated along the lines of reduced vertical component. This didn't seem likely, however (a) because it would mean a deterioration of the stereo performance and (b) DGG insisted, anyway, that the records had to be played with an approved stereo pickup.

ANOTHER SYSTEM

Others speculated as to whether DGG had revived one of the discarded stereo systems. Again, this seemed unlikely, because there would have been no point in them specifying a standard 45/45 pickup, or of sponsoring a non-standard system.

In point of fact, there would appear to be nothing different or unusual about the DGG records in a technical sense.

If there is to be a difference, it would probably be that the recording engineers will see to it that the balance between instruments and channels will be so controlled that the records will sound well, whether reproduced through a mono or a stereo channel—always assuming a stereo pickup.

But, then, this may already have been done in other stereo discs without rating a special name!

But whether or not there is anything especially unusual about the discs, the first sample to come to hand rates very highly in my book.

It is "Cacilien-Messe," Joseph Haydn, DGG 138028/29 SLPM. (Two records).

Reproduction through a stereo channel was superb, with no hint that anything had been sacrificed. With the pickup switched to mono and one channel silenced, it still sounded excellent, though lacking the breadth of stereo.

By chance, a mono version of the same performance was available for test (LPM 18545/46). Played over the same channel, I could sense little difference between it and the stereo version.

However, I'm not sure that this proves anything, since a few standard stereo discs, picked at random and played as mono, sounded fine also.

In other words, there's nothing to suggest that DGG have made any strictly technical contribution to the problems of compatibility with the new release. At most, they may be able to remove some of the alleged hazard as to whether or not a stereo record will sound okay, played mono.

Referring back to the DGG records, you may be interested in Julian Russell's appraisal of them. It follows:

"Jochum and the Symphony Orchestra and Choir of the Bavarian Radio, together with soloists Maria Stader (soprano), Marga Hoffgen (contralto), Richard Holm (tenor), Josef Griendl (bass) and Anton Nowakowski (organ) offer an impressive performance of this lovely work.

"The well-trained choir sings expressively, the soloists deal efficiently with the manifold problems of their parts, and the orchestra, always audible when necessary, retreats into discreetly balanced support when not.

"The fill, Handel's F Major Organ Concerto, played by the same orchestra and conductor, but with Michael Schneider as soloist, provides just as rewarding an experience as the Mass."

THE WRITER SAYS:—

I have the impression that some of the best stereo crystal pickups currently in use are better—not worse — in general characteristics than their mono antecedents including some of the less ambitious magnetics.

SACRED RECORDS

THE latest Record Club to come to my notice is one sponsored by the Gospel Film Ministry Ltd., of 599 George Street, Sydney, with offices in other capitals.

Under the slogan "Increase The Sacred Atmosphere Of Your Home" they are distributing Australian pressings of sacred recordings issued in America by Word Records Inc.

They charge a 2/6 enrolment fee, membership thereafter being maintained automatically by periodic purchase of records. If three 12-inch LP's are purchased at 57/6, within a six-month period, a fourth can be selected "free" from the catalogue.

Three discs from their current range are reviewed below. Note that they carry the prefix letters "GFM."

★ ★ ★

"The Crucifixion," by John Stainer. Presented by the Oratorio Society of New Jersey, cond. Clarence Snyder. GFM 10-W4006—LP. (Mono.).

"The Crucifixion" is a cantata which is well known and presented frequently, if sometimes indifferently, in local churches during the Easter period.

It tells the story of the Crucifixion in language which departs very little from the original Bible account. Solo, duet and chorus are interspersed throughout, with organ accompaniment.

The present recording was made, during January, 1956, in St. Lukes' Church, Montclair, New Jersey, with its regular organist Frank Scherer. I am given to understand that it is the only LP recording of the work currently available in Australia and, on this score alone, it should be of interest.

Aegis

2 INDEPENDENT 8-W. AMPS. IN ONE CHASSIS

PUSH-PULL OUTPUT

CHOICE OF 3 INPUTS

6 VALVES plus diodes

THE WORLD'S MOST ADVANCED STEREO AMPLIFIER

PERFORMANCE FIGURES CHECKED AND VERIFIED IN TEST-LAB. OF ONE OF AUSTRALIA'S LEADING VALVE MANUFACTURERS!

STEREO Six-88 Amplifier has a full 16 Watts of Power!

TECHNICAL SPECIFICATIONS FOR EACH CHANNEL

POWER OUTPUT RATING: 8 watts r.m.s. max. **DISTORTION:** Total harmonic at 1,000 c/s and 7 watts measures 1.34 per cent; total harmonic at 1,000 c/s and 5 watts measures 0.97 per cent. Intermodulation 40 c/s and 5 kc/s (4:1) at 7 watts measures 1.81 per cent; intermodulation 40 c/s and 5 kc/s (4:1) at 5 watts measures 1.65 per cent.

HUM AND NOISE LEVEL: 53 db average below 8 watts with no input loading.

INPUTS: Choice of three—(1) Stereo, (2) Monaural, (3) Radio Tuner. For crystal pick-ups only. Built-in compensation for flat playback requires no external RC networks.

SENSITIVITY: Pick-up—100 mV for 7 watts output; Radio—50 mV for 7 watts output.

FREQUENCY RESPONSE: At 1 watt output within 2 db of 1 kc/s level measures 30 c/s to 60 kc/s; at 7 watts output within 2 db of 1 kc/s level measures 30 c/s to 10 kc/s.

OUTPUT RESISTANCE: Approx. 0.5 ohm on 15 ohms termination.

LOUDSPEAKER IMPEDANCES: Choice of three, accommodating (1) 3½ to 4 ohms speakers; (2) 7½ to 8 ohms speakers; (3) 15 to 60 ohms speakers. Instant selection; no links to arrange.

POWER SUPPLY: Full wave voltage-doubler using silicon diode rectifiers delivers 260 VDC at 130 mA and 6.3 VAC at 4.1 A. No reserve for external devices. The primary circuit incorporates a safety fuse. Designed for 240 volts, 50 c/s mains.

VALVES USED: Two type 12AX7 and four type 6BM8 plus two silicon diodes, type OA210. Each of the six are double valves.

FRONT CONTROLS: From left to right (see photograph above)—Selector Switch, Bass Control, Treble Control, Balance Control and Volume with Mains ON/OFF Switch. Bass control: at 100 c/s, 11 db lift and 9 db cut. Treble control: at 10 kc/s, 11 db lift and 15 db cut. Balance control: equal output from both channels to full cut-off on either channel.

SIZE: Front panel 13½in long, 4¾in wide, depth not more than 7in behind panel.

COLOUR: Front panel is light beige with white calibrations, white knobs with lacquered, turned brass inserts. Because of its attractive, entirely neutral shade, the panel will in no way clash with surroundings.

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The organ and choir is excellent but I found the solo work somewhat disappointing by comparison. This is no fault of the soloists—John McCallum, tenor, and Chester Watson, bass—but seemingly an unfortunate combination of acoustics and choice of solo microphone.

The choice may have been dictated by a desire to ensure clear diction and, in this respect the aim has been achieved. But the voices have a hard, metallic quality, which is out of keeping with the excellent recording of organ and choir.

Speaking of the organ, there is a brief interlude, half-way through side two, which will put pickups and speakers to a searching test. "There was darkness over the land" is the theme and the organ pulses darkly and solemnly, using only its longest pipes. What a small, unbaffled loudspeaker would make of this I can only imagine.

Technically, my main criticism of the recording is an obvious tape or amplifier hiss, which persists throughout, except for breaks between stanzas. This and the hardness of the male solo voices makes it desirable to play the disc with the treble control retarded; the general result is then acceptable.

But, then, I say this from a hi-fi angle. Played in churches over more average amplifier systems, the points may pass unnoticed.

The jacket, by the way, carries the words substantially in full, as written by Rev. J. Sparrow-Simpson, M.A. (W.N.W.)

★ ★ ★

"Hymns Immortal" sung by The Religious Hour Choir of Baylor University, directed by Leroy Yarbrough. "Crown Him With Many Crowns," "Melody Divine," "And Can It Be," etc. GFM21-W3043—L.P. (Mono).

At first encounter, I was all set to dislike this record, mainly because I am not enamoured of the exaggerated tempos and heavy ornamentation which is characteristic of so much modern American hymn singing. When the techniques are applied to "Hymns Immortal," they seem—to me—to be even more out of place.

However, the remainder of the selections, including the whole of side two, are treated in much more restrained fashion and are the better for it. In all, there are five hymns on side one and six on side two, most of which will be familiar to prospective purchasers of sacred discs.

Technically, the recording quality is good and the surface noise commendably low. For those who like hymn records, it could be a useful addition to the collection, either for use personally or in church meetings. (W.N.W.)

★ ★ ★

Frank Boggs with Don Hustad Chorale: "If You Know The Lord," "The Lord's Prayer," "Ivory Palaces," "Precious Lord, Take My Hand." GFM 1006-2EP. (Mono).

Frank Boggs has a strong, pleasant voice and bears comparison with other American Gospel singers, who are better known in this country.

The Don Hustad Chorale supplies a pleasant and varied background but the soloist always predominates.

All the hymns are well known and the four numbers on this 7-inch 45 r.p.m. disc represent good value. The recording is technically well up to standard. (W.N.W.)

★ ★ ★

"My Faith Looks Up To Thee" The Merrill Staton Choir. Philips 682165BL.

If you like traditional hymns sung in a simple, straightforward manner, you will certainly like this recent release by Philips.

It contains some 15 hymns, in whole or in part, some of them grouped as simple medleys. They are presented by a compact male group singing in parts that, from memory, follow closely the traditional settings.

Very sparing accompaniment is provided by a Hammond organ and a celeste but the emphasis all the way through is on vocal harmony—and very good harmony it is, well balanced, true and consistent.

Technically, the recording is excellent. Reproduction is clean and there is no surface noise.

As a guide to what the record contains, the hymns on side one are as follows: "He Keeps Me Singing," "My Faith Looks Up To Thee," "In The Garden," "Jesus, Saviour, Pilot Me," "Though Your Sins Be As Scarlet," "Love Lifted Me."—(W.N.W.)

IN LIGHTER VEIN

EDDIE LAYTON, Hammond organ with rhythm accompaniment. Twelve popular selections including "All Of Me," "Ida," "Vienna, City Of My Dreams," "Nola," "Over The Waves." Mercury, stereo, SR60031.

For me, the Hammond organ can be variously appealing or monotonous in the extreme, depending on just how it is played and by whom. In the hands of Eddie Layton, billed as the "star of the exquisite Mermaid Room of New York's Park Sheraton Hotel," there is no room for monotony.

In this recording, the organ is used not as a solo instrument but to provide body—and very good body at that—to a rhythm section comprising xylophones, drums, guitar and bass. The resulting combination is pleasing indeed.

Arrangements are suitably varied and, along with the numbers, should appeal to anyone in the average home, with an ear for rhythm. It's a record that will stand a lot of playing.

The percussion sounds are clean throughout. Just here and there, the organ or the recording of it, carries a hint of being pushed to the limit of its available amplitude but I doubt that many would notice it.

And the stereo effect is excellent — dimension and spread, without obvious gimmicks. (W.N.W.)

★ ★ ★

Jerry Murad's Electronic Harmonicats playing "Dolls, Dolls, Dolls" Mercury stereo SR 60008.

In case you are misled by the term, the word "Dolls" means, here, exactly what it says. The selections have mostly to do with dolls as in "Wedding Of The Painted Doll," "March Of The Toys," etc. There are twelve selections in all.

Featured is a new recording combination — Jerry Murad and his electronic harmonica trio, involving a solo chromatic harmonica, a bass harmonica and a special chord rhythm type. They are backed, as necessary, by piano, drums, flute and reeds, string bass and electric guitars—the latter feeding directly into the mixing console.

The result is tuneful indeed, with rhythm as varied and yet as precise as you'll hear in many a long day. The selections are old enough to appeal to any age group.

Not everyone, of course, may relish the prospect of listening to twelve harmonica numbers in succession, electronics and rhythm accompaniment notwithstanding. I'll wager, however, that the disc will get plenty of use in smaller segments, particularly if there is a hi-fi enthusiast in the house.

Technically, the recording is first class. The surface is dead quiet and full use is made of the stereo system. You'll like it! (W.N.W.)

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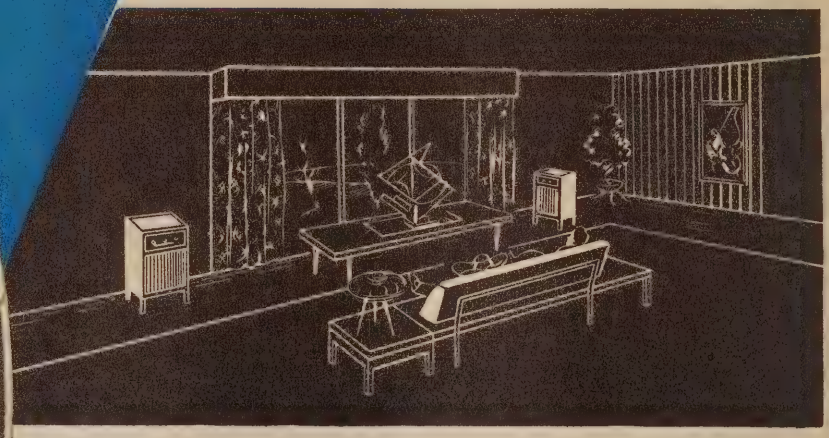

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IN REVIEW — By JULIAN RUSSELL

SEPARATION CARRIED TOO FAR?

Concert-Disc Stereo Sampler. Symphony of Dance . . . Played by Musical Arts Symphony conducted by Leonard Sorkin. Let's Swing. Played by Wendell Tracy and his Orchestra. Silk, Satin and Strings. Played by Radiant Velvet Orchestra conducted by Caesar Giovannini. Re-percussion. Played by The Percussive Art Ensemble conducted by Richard Schory. CSD2/1, CS-42/5, CS-39/4, CS-36/3, CS-21/2.

Festival are marketing a new label, Concert-Disc Stereo, that will remind many discophiles of early "two-channel" reproduction.

The Americans in those days were quick to seize on the sales value of gimmick sound emerging first from one speaker then another, and, for that matter, European companies were not entirely blameless for exploiting that feature, too.

Listeners sat awed while the sound bounced from the first channel to the second. A train would enter a room through one wall and roar and squeak its way out through the opposite one.

However, since those first days of stereo most European and American labels have aimed at creating the "wall of sound" referred to by Neville Williams in last month's issue of R.T. and H. Directional stereo, except when used for special effects mostly associated with recordings of operas and plays, nowadays invites critical disapproval.

LOW PRICED "SAMPLER"

Concert-Disc pressings are highly directional and the 35/ sampler disc seems designed to emphasise this feature. It comprises items played by dance bands, orchestras, percussion groups, a choir, an organ, a ping-pong game and the sounds produced by an electric train and a jet plane.

All have undeniable value in demonstrating that sound can be made to emerge from two channels. Musically, however, the effect is not so satisfactory.

A listener, seated at a reasonable distance from the source of music made in a dance room or concert hall, does not have to turn his head from side to side like a spectator at a tennis match, to register the origin of the sound.

Against this exaggerated separation of the two channels on the Concert-Disc pressings can be weighed the quite extraordinary clarity of the reproduction, though some listeners may find it a little strident at the normal setting of controls. The quality of the sound, however, is good enough to permit reduction of volume without, in most cases, any loss of definition.

The programs on the sampler and the four accompanying discs are aimed at a popular market. Their titles are self-explanatory.

CAMDEN SERIES—The Art of Lily Pons; Grand Canyon Suite (Grofe); The Art of Paderewski; The Art of Ezio Pinza. RCA, CAM 1, 2, 3 and 5.

Of current interest also is RCA's new Camden series. These 12in mono discs sell at £1/16/6 and their quality is impressive. I am informed that performances not previously recorded elsewhere are to appear in this format in addition to re-issues from 78s and early LPs.

There is nothing about the first four to suggest their "economy" price. In fact they can be compared without compromise to much more expensive products.

The appeal of the Paderewski disc will probably be chiefly historical. Its sound is pretty primitive by modern standards, though the surface noise from the originating 78s has been kept down to a surprisingly efficient minimum.

Paderewski's style, with its exaggerated rubatos sounds "old-fashioned" nowadays and his technique can be matched, and in some instances surpassed, by many contemporary pianists. Scholars, however, will find much to interest them in these performances which, in their day, were considered by many to be peerless.

On the other hand the Pinza disc should thrill anyone who can recognise tune. His voice is superb, his taste faultless, and the recording, though of variable quality in the accompaniments never less than effective and often first rate.

The recital offers a wide variety of arias and composers, old favourites appearing side by side with items that will probably be unfamiliar to many discophiles.

Lily Pons sings better on one side of her disc than on the reverse. The first

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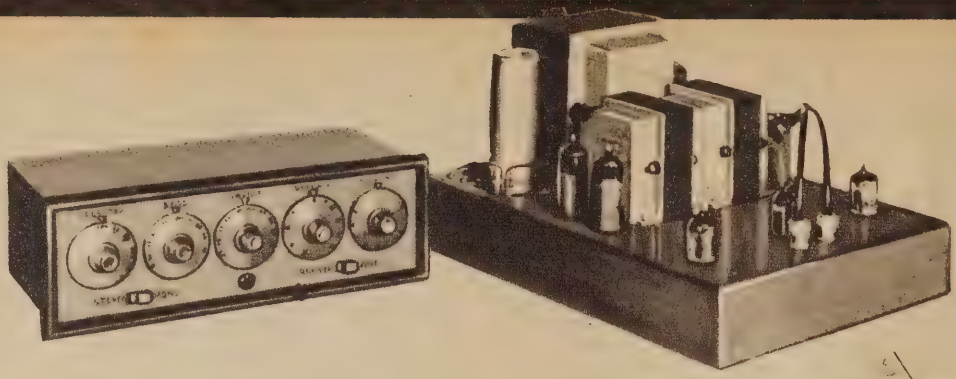

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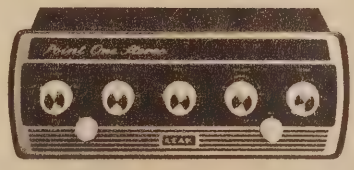

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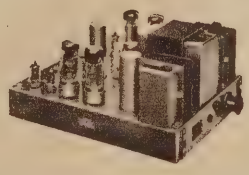

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side is made up of items recorded in 1930-31, the reverse 10 years later.

During the later period her voice lost some of its almost mechanical accuracy and an earlier tendency to hardness of tone deteriorated still further.

But her skill was always indubitable, however little she had to convey emotionally.

The Grand Canyon Suite represents splendid value. The performance by the Oslo Philharmonic Orchestra conducted by Oivin Fjelstad is colloquially expressive, without any hint of a foreign accent — an unusual achievement for a continental orchestra playing an American score.

The engineering is quite up to the best of modern standards.

★ ★ ★

Mendelssohn — A Midsummer Night's Dream Incidental Music. Played by the London Symphony Orchestra conducted by Peter Maag, with sopranos Jennifer Vyvyan and Marion Lowe. Decca. SXLA 2060.

I can recommend this disc as an example of modern stereo at its best. The sound is beautifully spread, with plenty of depth and perspective but without freakish separation.

The dynamic range is wide but never too soft or too loud to cause discomfort in an average-sized room.

Seven of the original 12 items composed for the special performance given in Potsdam Palace in 1843 are included. All of them are exquisitely played.

The freshness of many of the items grown all too familiar by indifferent performance by debased combinations will surprise many listeners.

Even the old Wedding March gains new dignity — and excitement — treated in this manner. And the delicacy and precision of the playing in the Scherzo should charm connoisseurs and tyros alike.

A beautiful balance is maintained throughout the disc between bass and treble with the inner voices transparent yet audible without effort.

The hyper-critical might complain that the two sopranos deliver their enchanting songs in a precious manner reminiscent of English provincial oratorio, and that a loud chord towards the end of the Intermezzo hangs in the air rather longer than it should. Otherwise it is all exquisite music, played to perfection, and reproduced with all the benefits of the most skilled modern sound engineering.

The program is made up of the Overture, Scherzo, the song "Ye Spotted Snakes," Intermezzo, Nocturne, Wedding March, Dance of the Clowns, and the Finale.

★ ★ ★

Sullivan — Pineapple Poll. A Ballet arranged to Sullivan's music by Charles Mackerras. Played by the Pro Arte Orchestra conducted by John Hollingsworth. Pye. SPLP 1012.

This, too, is splendid stereo, its tone a little brighter than Decca's though never shrill on that account. I found my pressing improved by very slight cutting back of highs. The orchestral definition is brilliantly clear, the ensemble splendidly unanimous, and the attack and release razor-edged.

This is no arrangment of Sullivan's music that might be heard in a cinema or played by the local band in a park on a Sunday afternoon. Mackerras twists the tunes, harmonies and orchestration around with inexhaustible ingenuity, creating virtually entirely new sound always firmly based, however, on the original.

And the pedigree of such arranging is ancient and honourable. The great Johann Sebastian Bach was in his day, an inveterate arranger of other men's music.

My only criticism is that Pye have not been over generous with the playing-time.

★ ★ ★

Handel — Music for the Royal Fireworks. Concerto a Due Cori in F Major. Edited and conducted by Charles Mackerras. Pye PLC 5001. Mono.

The enterprising young Mackerras — he is 34—uses the original Handel scoring for his version of the Fireworks Music. This comprises 26 oboes, 14 bassoons, 4 contra-bassoons, 2 serpents, 9 trumpets, 9 horns, 3 sets of timpani and 6 side drums.

The recording of such a combination presented many problems, not only of sound but of logistics. To assemble that number of oboists, even in London, for a recording session meant that many of them couldn't turn up until they had finished their work for the day — which in some cases was 11 o'clock at night. That was the hour at which the tape was recorded.

However, all the technical hurdles were most successfully cleared and the resultant sound is unique. The genteel arrangements that have, till this recording was made, replaced Handel's original scoring resemble it as little as a cafe trio's efforts to play the Tristan Prelude on a piano, violin and cello resemble a Bayreuth performance.

The best word I can find to describe the Mackerras version is formidable, both in concept and execution. Only on the last band, where the Minuet is repeated with the addition of fireworks effects, is the reproduction anything but completely convincing. The fireworks are not nearly so effective as the instruments.

Handel students will find the Concerto, with which the Fireworks Music is coupled, of rare interest. They will recognise some of the movements as coming from familiar sources — oratorios and organ concertos by the same composer — but the orchestration and treatment will be quite new.

Handel re-scored these pieces for two "concertini" of oboes, horns and bassoons, with strings added. In their new guise they sound deliciously fresh and spontaneous. The engineering throughout is excellent.

★ ★ ★

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coteries regarded by many of their fellow-musicians as eccentrics. To say that she popularised the harpsichord is perhaps to exaggerate. Even today many concertgoers disparage its "jangling, feeble tone" and compare it condescendingly with the modern piano.

Others, however, with more sensitive taste, came more and more under the spell of her immaculate technique and wide musicianship, both of which she displays in this recital. The selection of items is well designed to demonstrate the great range of her musical thought and the stylistic purity of her treatment of many composers. The sound is excellent except for some slight surface noise on my pressing.

Changes of registration have been effectively recorded, and the tone of her instrument, a modern Pleyel built to her design, emerges with great clarity and fidelity.

Those who think the harpsichord sounds like a piano with paper stuck between the wires will be surprised at the force and virility of the instrument under her magic hands. A worthy memorial to one of the finest musicians of our age.

★ ★ ★

Sibelius — Symphony No. 5 in E Flat. Karelia Suite. Played by the Sinfonia of London, conducted by Tauno Hannikainen. World Record Club TW 104. Mono.

The sound on this economy-priced disc is outstandingly good, and so is the performance conducted by one whose name, strange to me, suggests Finnish origin.

He interprets the symphony in what might be called the classical Sibelius style, with abrupt ejaculations from the brass ripping through the score and strings that give the impression of tenseness however lyrical the passages they might be playing.

The opening of the Finale, for instance, is as taut as a wound-up coil-spring eager to release its energy. And in this movement the basses enter with the "tune" deep down, without grunting.

This atmosphere of controlled force permeates the whole symphony, even in the great pizzicato phrases at the beginning of the second movement. And Hannikainen imparts an unusually strong note of desolation in the working-out section of the first movement.

The music of the coupled work, the Karelia Suite, sounds commonplace after the sublimity of the symphony, despite its effective orchestral raiment. Yet just as much care was obviously lavished on its preparation, and playing and engineering is of the same high quality as in the major work on this disc.

★ ★ ★

Tchaikowsky — Sleep'ng Beauty Ballet Suite. Played by the Sinfonia of London, conducted by John Hollingsworth. World Record Club. TW105. Mono.

The sound here is admirable, too—rich-toned, clean, with plenty of depth and a wide dynamic range. The selection from the complete ballet is a very full one.

Hollingsworth's playing tends to unevenness. Some of the items are phrased with infinite grace and flexibility, others move slightly stiffly.

In the first group can be included the Entrance of the Fairies, the Panorama, the Waltz on the second band of side two, and the famous Blue Bird variations.

In the second can be placed the famous Sleeping Beauty Waltz, and the opening strains of the first Adagio.

The woodwind solos, except for those of an oboe who occasionally becomes a trifle too soulful, are all beautifully delivered, and most of the climaxes excite without bullying.

★ ★ ★

Schubert—Symphony in C Major, Op. Posthumous (The Great). Played by the Boston Symphony Orchestra conducted by Charles Munch.

A disappointing performance, though the sound is good. Munch's treatment is strangely insensitive. His tempos are stiffly metronomic with consequent loss of rhythmic vitality. The brass interjects ponderously during the introduction and much of the fast section gets along almost like a jig. Even the Scherzo is stiff-jointed and the beginning of the Finale is coarsely out of character and style.

Munch can be superb in his readings of French music, but he doesn't seem to get the idea here at all. Schubert's rather garrulous reiterations call for the gentlest handling to prevent them becoming wearisomely redundant. Munch gives the impression of leaving everything to look after itself.

★ ★ ★

Beethoven—Missa Solemnis in D, Op. 123. Performed by the Vienna Symphony Orchestra, the Vienna Academy Choir, Ilona Steingruber (soprano), Else Schuerhoff (contralto), Ernst Majkut (tenor) and Otto Weiner (bass), conducted by Otto Klemperer. VOX APL 11430. Mono.

The best features of this recording is its economical placing of this famous work on one 12in disc. Otherwise its chief faults are its capricious balance—especially in the Credo which is interrupted by a turnover—and its soloists, who make it sound almost impossible to sing well.

The choir seems sometimes to lack confidence, despite the fact that it is under the direction of one of the greatest living conductors. Yet in some miraculous way the sublimity of Beethoven's music manages to a large extent to emerge not too badly affected by these shortcomings of performance—to which, in addition to those mentioned above, I must add coarseness of orchestral texture.

A good stereo version of the Missa Solemnis should fix a ready market when one of the leading companies gets around to organising one. Its massive proportions and frequent antiphonal writing make it ideal for the benefits bestowed by stereophonic reproduction.

★ ★ ★

Haydn—Symphonies No. 94 in G (Surprise) and No. 99 in E Flat. Played by the Vienna Philharmonic Orchestra conducted by Josef Krips. Decca.

I find it difficult to understand why this disc was awarded a Grand Prix du Disque by the French Academie Charles-Cros last year. The playing has the merit of solid musicianship and the reproduction is good. But neither virtue is outstanding here.

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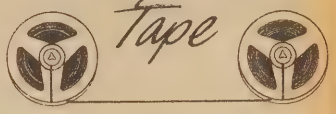

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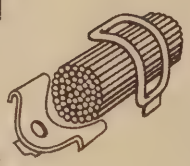

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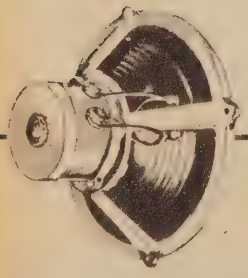

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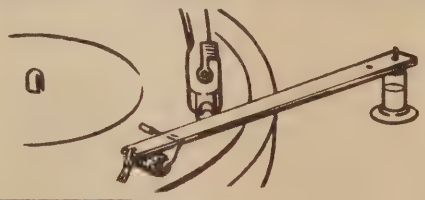

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Some listeners may find the coupling of special interest, for the No. 99 has seldom appeared on the local market in Australia and it is a delightful work well worth owning. Krips' performance leaves little to be desired, except the spark that would have made an entirely worthy reading a memorable one. And while Haydn lovers might not have the No. 99 in their libraries they are almost certain to own a "Surprise" which is unlikely to be eclipsed by this new version.

On the other hand, those who own neither might find the present coupling attractive.

★ ★ ★

Shakespeare—Ages of Man. A recital of excerpts from the Plays and Sonnets presented by Sir John Gielgud. Coronet KLC2692. Mono.

This disc takes its title from the opening speech, "All the world's a stage," from Act 2, Scene 7 of "As You Like It." In all there are eight items on each side drawn from the comedies, tragedies and historical plays. Five sonnets are included.

Gielgud delivers them with beautiful diction that avoids any hint of preciousness and has the good Shakespearean actor's knack of making the archaisms sound as if they were in current use. He occasionally interpolates short, interesting comments on what is to follow.

Shakespearean scholars used to the fruitier tones of members of the declamatory school might find Gielgud's voice a little light for some of the excerpts. Others might complain that he fails to change his voice often enough to "characterise" his performances.

But everyone should find something exciting somewhere during the recital, even if the whole fails to win their complete approval.

★ ★ ★

Lollipops—Favourite pieces of Sir Thomas Beecham. Played by the Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. HMV OASD259. Stereo.

Can the Royal Hunt and Storm Music from Berlioz' The Trojans or Debussy's L'Apres-midi d'un Faune rightly be described as "Lollipops?" Not to my mind. But you have only to listen to Beecham's affectionate handling of them to realise that he intended no disrespect by labelling them thus.

Indeed Beecham makes his affection for what he terms these "musical sweetmeats" manifest throughout the whole charming concert. There have been more notable recordings of some of the pieces — Cantelli's L'Apres-midi comes immediately to mind—but as a collection I can strongly recommend this disc.

The sound has been much improved by transfer to stereo.

And not the least attractive feature of the product is the portrait of the old gentleman himself on the sleeve, cigar in hand, panama hat worn over one evebrow, and a wicked twinkle in his eye, seated on a terrace somewhere on the French Riviera.

In addition to the two items mentioned above the program includes Overture to Poet and Peasant (Suppe), Valse Triste (Sibelius), March in D Major, K249 (Mozart), Le Rouet d'Omphale (Saint-Saens), Dance of the Sylphs from The Damnation of Faust (Berlioz) and March Joyeuse (Chabrier).

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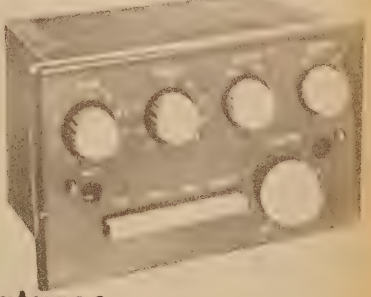

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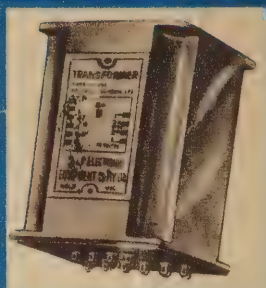

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	2525-15	10	8,000 P.P.	3.7 or 15
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E	896	15	10,000, 8,000 P.P.	15, 12.5 8, 3.7, 2
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†	4000-8	10	8,000 P.P.	2 or 8
†	4000-15	10	8,000 P.P.	3.7 or 15
†	4001-8	20	6,600 P.P.	2 or 8
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I.T.U.—HOW THE AMATEURS FARED

by John Moyle

AS you know, I had planned to write this story in the fullest possible detail, and to report in person to every Division of the Institute on my return from Geneva. It is therefore a bitter disappointment to find that my health is not good enough to do this. However, I have already had several long talks with the Federal President, Max Hull, who now has a large quantity of conference documents, including verbatim accounts of many important meetings, from which the case history of every amateur band can be assembled for future reference.

This general survey will, I hope, assist the amateurs of Australia to obtain a quick picture of what happened, and what I think we must do to get ready for the future.

ONLY A MEMORY

Geneva 1959 is now only a memory. For better or for worse, the radio scene for the next few years has been redefined, and the final agreement signed on December 21. The full document is now being printed and should be available for distribution quite soon.

Its pages of tables and regulations will clearly reveal how much work went into their preparation, but can tell nothing of the drama, the dangers, the tension, and the hours of frustration and achievement through which we lived during the long weeks of the conference.

Without doubt this was the most momentous conference of them all, one which grappled with the virtually insoluble problems and mistakes of the past, and attempted to deal with even more sweeping demand which we know the future will bring.

I only wish every amateur could have been present at least part of the time. He would have learned about the enormous pressures on frequency space which have literally made portions of the spectrum unworkable; he would have seen how amateur problems, important though they are to us, are only a small part of the incredibly complicated pattern of modern communication.

STUBBORN FIGHT

He would have seen, too, the stubborn and altogether admirable fight put up by all those interested in amateur radio in the face of this opposition, a fight in which every band has been retained, in most cases intact, and a final result obtained appreciably better than most of us hoped for.

I have already told you of the enormous dimensions of the conference, with its 1,000-odd delegates, committees, to the tune of about 100, and millions of foolscap sheets which made up the daily working documents.

I have also outlined the committee and working group structure by which the mass of proposals was processed and decided upon.

My stay at the conference was from the commencement on August 17 until November 19, the longest stay of any purely amateur delegate with the exception of A. L. Budlong, general manager of the A.R.R.L., who remained for a week or two after I left.

By the time I caught the plane for home, all our problems had been dealt with, and were being confirmed at the Plenary level.

Some minor changes took place here, all in our favour, and all the result of groundwork already done.

Firstly, let me say that the amateurs received an excellent hearing at every level of the conference and a very fair hearing at that. Even where criticism and opposition were hottest, every point was fully debated and fully considered.

Many long and important meetings were devoted to nothing else, particularly the series of committee four wrangles about the seven Mc band and its impact on broadcasting. Many powerful and even impassioned speeches were made in their defence, and I for one could not have wished for better treatment of our case.

BETTER REPRESENTATION

Secondly, the quality and quantity of amateur representation was better at Geneva than at any previous conference.

Apart from myself, A. L. Budlong and John Huntoon, of the A.R.R.L., were attached to the U.S. delegation as amateur representatives, and Len Newnham for some weeks to the U.K. delegation.

There were also five I.A.R.U. representatives from Region I countries, led by John Clarricoats (G6CL), who were present from time to time, and they did some useful work, particularly in sorting out some of the problems peculiar to that region.

But best of all there were capable delegates from many countries such as U.K., U.S.A., New Zealand, Argentina, Canada, Brazil, South Africa and some others who, being the actual spokesmen at meetings, fired the real bullets when the debates began.

Naturally, we got together on every possible occasion to discuss the position and this team work was quite a vital factor in getting things done.

In these circumstances, the importance of a Region III representative being present cannot be over-emphasised.

At this stage it might be appropriate to run through the bands to see how we fared.

I'm afraid this will involve some duplication of earlier reports, but I will give the picture in general without including all the odd footnotes involved.

Later on, when the Geneva regulations are available, no doubt "Amateur Radio" will print extracts from the tables in full.

IN REGION II

To help matters, I can say that in Region II, there were no changes of any importance to the old band allocations This was due undoubtedly to the preliminary work carried out by the U.S.A. in lining up all the countries in North and South America, so that any disagreements existing between them would not appear in the tables.

By their numbers, organisation, excellent liaison with the F.C.C. and commercial friends, the American amateurs exert a powerful influence, so much so that their delegation was persuaded to flatly oppose each and every proposition to change the status quo, and to be supported almost universally in Region II.

This solidarity overflowed to the advantage of amateurs in both Regions and III, and to me was an object lesson in how to organise.

I shall not, therefore, mention Region II in what follows.

1.8-2 Mc.

There was no problem here from our point of view. The status quo remains and we share with Fixed, Mobile and Radionavigation. The P.M.G. has no

Though seriously ill at the time, John Moyle, Editor of "Radio, Television and Hobbies," and representative at Geneva of the Wireless Institute of Australia, wrote this report for W.I.A. members who had sponsored his trip. It was published in the March issue of the Institute's journal "Amateur Radio," but is reprinted here in full for the sake of those who may not have had the opportunity of reading it.

given us a general allocation here, but in view of our other losses, maybe we can persuade them to find a suitable spot.

In Region I there was a fine old discussion for and against amateur operation, some Europeans being bitterly opposed, while others who had not previously allowed amateurs now wished to include them. U.K. was a strong supporter here.

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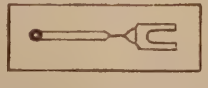

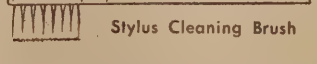

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European countries must co-operate to avoid interference with other services.

3.5-3.9 Mc.

This band is allocated generally to Region III, shared with Fixed and Mobile, by footnote Australia has restricted amateurs to 3.5-3.7 Mc exclusive, the remainder being given to the other services. India has an even more drastic footnote, limiting amateurs to 3.89-3.9 Mc.

From our viewpoint, this limitation comes from the P.M.G. and is in line with Australia's original ' proposal. Frankly, I find difficulty in appreciating the need for this footnote, because being a shared band, local administrations have authority to split it up in any way they choose, without further reference to the frequency table. In fact they have already done so.

NO FURTHER REDUCTION

But appearance in the table means that they cannot reduce our band any further.

7.1-7.3 Mc.

Regions I and III have lost the use of the shared portion between 7.1 and 7.15 Mc, which becomes exclusively broadcast. **But there is a rider that broadcast stations must vacate the exclusive amateur portion between 7 and 7.1 Mc.**

Frankly, this isn't worth much, because several countries now poaching there announced quite openly that they won't move until given clear channels, of which there are none.

To test the practicability of this rider, the Americans proposed that amateurs should continue with the present allocation until the International Frequency Regulations Board (I.F.R.B.) declared that the poachers had moved out. After a vigorous debate, the proposal was defeated by only two votes.

Australia was the only English-speaking country which voted against it.

But in all fairness, it wouldn't have done much good if carried, for the determination of countries such as Pakistan to stay put would have merely meant reversion indefinitely to the status quo.

"GET IT OR ELSE"

And as so many countries have obviously been told to get that 50 Kc. or else, they were happy to go along with the pious hope of clearing the Amateur band, but were not prepared to wait until the hope became reality.

As I have already said, the standard and bitterness of the debates on this matter, the special committees set up to handle it, and the good old duck-shoving that went on, convinced me that high political hands were at work, far beyond any capabilities of mine to influence.

The relative documents even refer to the undesirability of Amateurs sharing bands with broadcasting, which put the death-blow to my initial efforts to get daylight sharing.

But our case for the latter is so good that I for one wouldn't stop trying.

A hard pill to swallow was the general agreement on an engineering level that bad band management, jamming, and duplicated services were largely to blame for the congestion on the broadcast bands.

Unfortunately, national prestige is so wrapped up in having mighty voices on the air (and who listens?) that even the smallest and newest countries are spending more than they can afford to join the chorus. No one will give way, and so the mess continues.

21-21.45 and 26.96-27.23 Mc.

The 21 Mc. band was conned from many angles and quite a few suggestions were made for slicing it for various reasons, but none of them made the grade.

When I left Geneva there was still a suggestion, unsettled, to allocate 5 Kc. at 21 Mc. for space research, but apparently it was abandoned, for I see no mention of it in latest advice. So this band continues unaltered.

The 27 Mc. band is available in Regions I and III, shared with industrial,

During a coffee break at Geneva. From left: Len Pearson, Controller Radio Branch, P.M.G. Dept. and Deputy Leader of the Australian delegation; John Moyle, author of this report; Eric Anderson, Dept. of Civil Aviation and member of the Australian delegation.

The Amateur hadn't got a chance except in Region II where broadcast demands apparently are more modest.

Incidentally, the leader of the New Zealand Delegation made a particularly good speech in defence of this band in which he paid a glowing tribute to the value of his own and other Amateurs and their work for the community. It was a highlight of the discussion.

14-14.350 Mc.

The thing which saved this band was the refusal of the U.S.A. to agree to any curtailment. Both the fixed services and broadcasting would have liked a slice of it, and both made moves to get it.

But both were prevented from coming into an open meeting where they might have gained some support, and perhaps secured some regional arrangements, however impractical.

I was, therefore, particularly pleased that Australia was persuaded not to press her proposal to cut the band by 100 Kc.

This left India's even more drastic proposal to cut 150 Kc. off the high end for broadcasting out on a limb, and it got no further.

But fundamentally, no one was enthusiastic about pushing a lone hand against powerful American Amateurs who are audible somewhere or other all around the clock.

And while this position remains, I don't think they ever will.

scientific and medical services, and we can use it if we wish.

28-29.7 Mc.

This was a most hotly contested band. At least three special group meetings were devoted to fighting off proposals from the meteorological aid people, who wanted half a megacycle for their old-fashioned radio-sondes, and from France and Japan, in particular, who wanted slices in which to operate fixed and mobile services.

To me our success here was the best example of organised Amateur resistance in which our own Australian delegation played no small part.

SUCCESSFULLY COUNTERED

When I left Geneva, the met. aid had been successfully countered, but there were two proposed footnotes to allow fixed and mobiles in Europe and Japan to use part of the high end.

Apparently the battle against these was joined once more in the Plenary session, for the footnotes do not appear in the table, as I have it now, and the band is therefore unchanged.

It is probable that fixed and mobile services will operate under Section 8 of the Regulations, which means that they do so at their own insistence and without any protection against interference, particularly as I think Japan has been operating with low power for river boats for some time. They are not likely to be a serious worry to us

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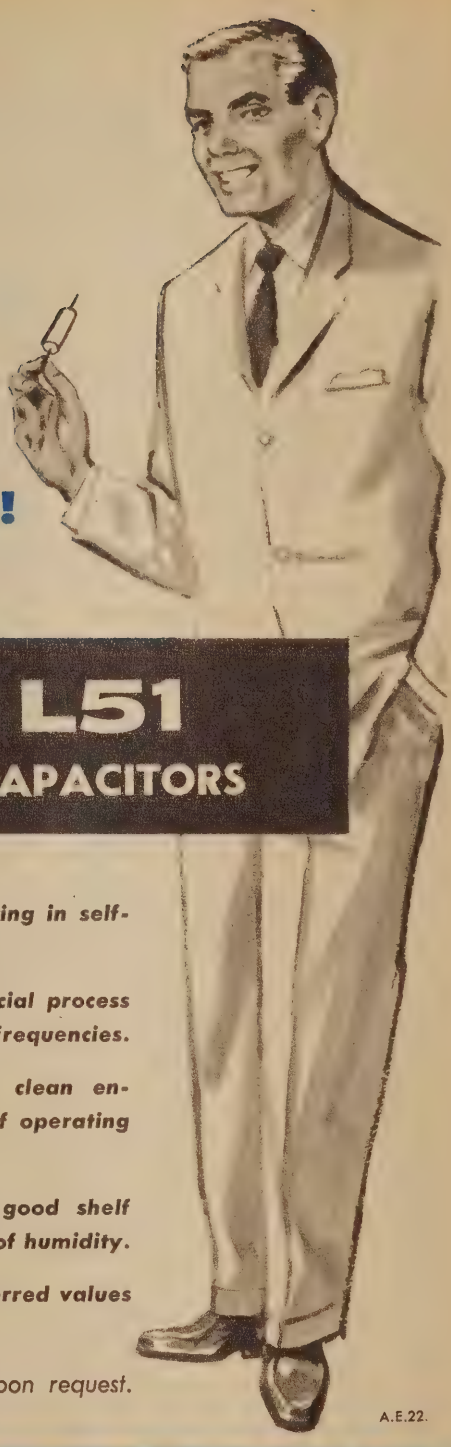

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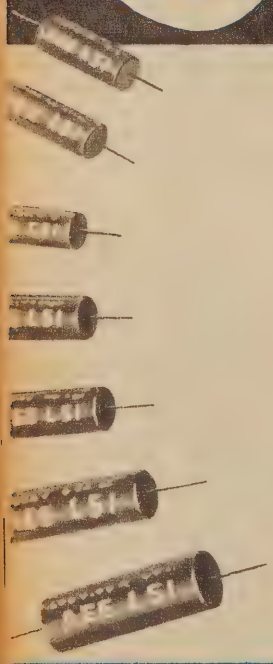

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56-58 and 146-150 Mc.

These bands have been re-aligned in Australia to fit in with our TV assignments, and two megacycles have been taken from the lower band. This is unfortunate, but as we have never used the full four megacycles in the past, it is not surprising that the authorities should think we didn't need it. Should it be decided not to proceed with the suggested Band 1 for TV, it could be that we would get our old 50-54 Mc assignment back again, which would be fine. At the moment we can only hope.

As both bands are out of step with world-wide assignments, they are covered by special footnotes to the table.

420-450 Mc.

This has been a shared band for Amateurs although we have never had a firm allocation. Our original proposals omitted Amateur altogether, and one of my tasks was to remedy this if I could.

This was eventually made possible because of the introduction of a new Radiolocation type of service, the sponsors of which had no objection to sharing with Amateurs when the service itself should be established.

This band now is fully occupied with Fixed and Aeronautical services, but in the next few years changes are likely to occur which could make it possible for us to use it. At any rate, we are back in the table, and some day we might well be very glad that we are.

1215-1300, 2300-2450, 3300-3500, 5650-5850, 10,000-10,500, 21,000-22,000 Mc.

These bands follow the general pattern of the highest frequencies in the table, except that they have been extended beyond the old limits and are all annotated as shared with Radiolocation in Region III. In all cases, the latter has priority.

The band 3300-3500 Mc is another from which Amateurs in Australia had originally been excluded, but it was found possible to change thinking on this point.

MORSE CODE

A point of interest is that the lower frequency limit for which the Morse Code is required has been raised to 144 Mc.

Australia had proposed this to be 50 Mc, and was supported by Argentina. Both the U.K. and U.S.A. initially opposed this and just before I left Geneva had compromised at 250 Mc (not a very practical figure) and no arguments of mine could shift them.

However, they must have had second thoughts, for at a subsequent Plenary meeting, they agreed to 144 Mc.

Our delegate fought hard on this proposal, but in any case it will not be allowed to affect the terms of our limited licence. It just brings the figures so much closer.

LESSONS LEARNED

Geneva taught me several new lessons and underlined many old ones.

Fundamentally, these conferences are meetings of national delegations, each of which has a vote. It follows, therefore, that the first aim is to convince each delegation that the claims of the Amateurs are as strong as those for any other service and thus to secure votes for them.

It is far too late to initiate action at the conference itself, by which time most decisions have been made up to this level.

It follows, too, that the Amateurs should work on a long-term basis to establish goodwill and a high priority at home, and on a short-term basis to see that they always have a representative as a member of the delegation to press home the Amateur position and improve it if he can.

A team of such Amateur representatives can wield a powerful influence, even if it does not include a member from every country, which would be too much to ask.

We fell down because our preliminary work over the years was not good enough, and we were obliged to take drastic action at a late hour.

DID NOT UNDERSTAND

It is true that the inexplicable attitude of the P.M.G. in several matters did not help, but the fact remains that the members of F.A.S.C., who prepared our brief, did not understand the Amateur position, and were thus unduly influenced by the P.M.G. representatives and their assessment of our proposals.

At Geneva I am quite sure that I managed to effect a big change in this and ultimately found our delegates most helpful in all matters which did not contradict the Australian brief.

Many of them did good work for us in defending our bands when they were under attack.

Had this attitude prevailed during the initial F.A.S.C. meetings, we might have started out more favourably.

The countries which really carried the fight for Amateurs were those such as the U.K. and U.S.A. in which Amateur organisation is well developed and relations with the authorities and others are good.

In countries where ordinarily the reverse is the case, dangerous weak spots were apparent.

The I.A.R.U. is not a very effective body at such a conference.

In the first place, there is no national co-operation except in Region I., in which the R.S.G.B. is the dominant society.

In Region II., the prestige and influence of the A.R.R.L. renders it unnecessary, and in any case the A.R.R.L. officers (also federal officers of the I.A.R.U.) cannot perform both jobs at the conference.

Region III. is so dispersed that no real I.A.R.U. representation is practicable.

FREQUENTLY HELPFUL

It is frequently helpful to have an I.A.R.U. representative who can speak more freely than an Amateur attached to a delegation, but in the present circumstances it is only natural that the I.A.R.U. representatives, all from Region I., are strongly preoccupied with their own problems.

It is hard to visualise any practical method by which the I.A.R.U. could finance and support a really representative organisation covering the world.

Nevertheless, the I.A.R.U. team worked hard and I do not mean to belittle their efforts by these general comments.

Closer to home, we have two major reforms to make.

(Continued on Page 149)

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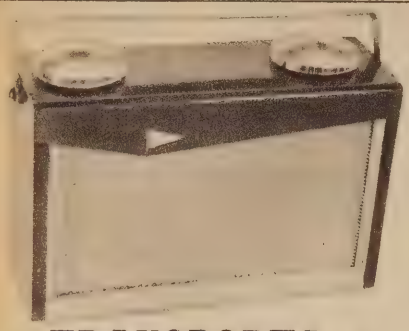

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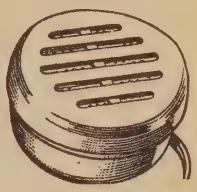

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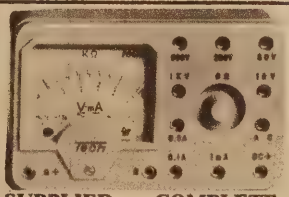

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Radio Amateurs do not spend their whole spare time on the air. Many assist in providing a service to the community in various ways such as radio instruction for youngsters, technical help to various bodies and communication organisations in time of emergency.

RADIO amateurs are making a valuable contribution in assistance to the blind in a venture of the Cambridge and District Amateur Radio Society, England. As mentioned some time ago in these columns, it was the desire of authorities that amateurs would service the "Talking Books" used by blind persons. The "Talking Books" consist of a record player having speeds of 24 and 33 r.p.m. and an amplifier. The records available give a playing period of an hour.

The records are readings of various books made in most cases by B.B.C. announcers and are supplied by post from the Nuffield Talking Book Library. It was the society's intention that each sightless person in possession of a "Talking Book" should have a member assigned to him to maintain the equipment. Generally speaking, the equipment gave little trouble and one member was able to care for a number of machines.

The society in its work for the blind found another problem that was worrying local blind institutions, namely, the service of broadcast receivers issued to blind persons from the "Wireless for the Blind Fund." The members decided to undertake the servicing of these receivers some 250 in Cambridgeshire.

It was found that after the back log of unserviceable receivers was dealt with club members were able to give prompt and effective service.

It was most convenient that all the service work should be carried out at the shack of one member, where faults common to one type of receiver could be readily traced. Spare parts were supplied by the local society for the blind.

The service performed was greatly appreciated by those concerned with the welfare of the blind and the blind themselves and denotes another phase of activity of the radio amateur in the interests of the community.

U.K. AMATEUR EXAMINATION

AMATEURS and enthusiasts will be interested in the following examination paper set by the British G.P.O. for the 1959 Radio Amateur Examination. Candidates were required to answer both questions in part one and six out of eight questions in part two. Of the 210 candidates sitting 159 or 76 per cent passed.

The various national licensing authorities are responsible for the standards of the examinations set for intending amateurs. Most British Commonwealth nations have similar standards.

The technical requirement for both classes of licence is similar here but other countries such as the U.S. vary standards for different classes. In that country the higher the grade of licence the greater the operating privileges allowed. Many countries only licence one class of amateur, but in others arrangements are made for novice, technical and limited operation.

The following were the questions listed in the U.K. examination:

PART ONE

1. (a) What are the conditions under which recorded mesages may be retransmitted?

(b) What are the licence requirements for the receiver at an amateur transmitting station?

(c) What are the conditions under which an amateur transmitting station may be operated by persons other than the licensee?

(d) Who may inspect an amateur transmitting station?

(e) What records shall be kept in the log of an amateur transmitting station?

2. With the aid of diagrams explain the precautions that are taken in the construction of a transmitter for use at an amateur station in order to minimise the radiation of harmonics.

PART TWO

3. Describe the construction of an aerial and its associated feeder for use on the 3, 5Mc band. Explain its action.

4. A battery of cells, whose e.m.f. is 12 volts on open circuit has a potential difference of 9 volts between its terminals when it is connected to a resistor of 24 ohms. Calculate the value of the current flowing in the resistor. Why does the terminal p.d. of the battery fall when current is being taken from it?

5. Explain the superheterodyne principle of reception.

6. Describe, with the aid of diagrams, a method of keying a telegraphy transmitter. Why is it not advisable to key the oscillator stage?

7. Describe the construction and action of a meter suitable for measuring radio frequency currents at frequencies between 2 and 10 Mc.

8. Draw a diagram of a low-powered amplifier using a penthode valve. Indicate the value of the chief components. What value of cathode bias resistor would be required if the anode current is to be 12mA, screen current 3mA and grid bias 5 volts. What would be a safe wattage rating for the resistor?

9. What is meant by "an alternating current of sine wave form"? What is the effect of (a) inductance (b) capacitance in a circuit in which alternating current is flowing?

10. Explain how the anode volts/anode current and grid volts/anode current curves of a thermionic valve are plotted.

How are the mutual conductance, anode resistance and amplification factor of a valve calculated?

Morse instruction

AN interesting variation in the methods of learning the Morse code has recently been presented by the John F. Rider Co. in the U.S. It is known as their "Sound 'n' Sight" system and some of the ideas incorporated may be of interest to intending amateurs.

The sound and sight method in an expanded form has been tried out by the U.S. Army Signal Corps, and faster learning of the code has been reported.

The scheme briefly runs as follows: The student first listens to some records which transmit various code characters. Three seconds after each character is sent a voice announces the verbal equivalent in "dit dah." This is aimed at helping the student distinguish between a dit and a dah and may even weed out those that are unable to make such a distinction. Following this, the student puts aside the records and picks up a set of flash cards.

This part of the course is unique. One side of the card carries a letter of the alphabet, on the other the equivalent in dit dah's. The student looks at the Morse symbol and guesses at the equivalent letter, if the guess is correct the card is placed in one pile, if incorrect into another. The student goes through the stack time and time again until he can "guess" correctly all the equivalents in a single run.

"REINFORCED LEARNING"

Theory is apparently that as the student looks at each card after he has guessed what letter its symbol represents learning takes place. According to the publisher this is "reinforced learning." The same procedure is subsequently followed for numerals and punctuation marks.

At this stage the student has learnt groups of dits and dahs and their equivalent in letters and numerals. Now he goes back to records and listens.

A code character is sent at slow speed and three seconds later the announcer gives the dit-dah equivalent and the phonetic name of the letter (H becomes Hotel). After the student is able to go through this a couple of times without error he begins copying from records at three words per minute. The announcer no longer speaks, instead after each run of 80 characters the student checks back in the instruction manual and corrects his copy.

Again, after a student is able to go

through each run with only a couple of errors he is told to proceed to the next higher speed. Speed jumps are at 1 w.p.m. but the student is cautioned against increasing speed more than once per day. This is said to do away with the learning plateaus that most have experienced during the learning of the Morse code.

The "Sound 'n' Sight" course comes in two parts.

The novice portion takes the student up to 8 w.p.m. while the advanced portion goes on up to 20 w.p.m. Both speeds are high enough to cover the usual "loss of speed" due to examination jitters. It is manufactured for use on 33 r.p.m. turntables but can also be used on 45 r.p.m. tables with corresponding increase in speed.

N.S.W. division premises

THE N.S.W. Division of WIA took over their new office premises early in February. Located at 14 Atcheson Street, Crow's Nest, on the north side of the Harbour, some five miles from the G.P.O., they are readily reached by all means of transport. The secretary, Norm Beard, VK2ALJ is already installed with his various records and equipment. The first meeting to be held there was the February gathering of the VHF and TV group.

Thirty-eight persons attended, making things a little crowded, but with future alterations to internal walls the lecture hall will provide sufficient space for all Divisional section meetings except the monthly general meetings. Lecturer at the meeting was G. Jenkins, VK3ZCN, who covered as his subject "Noise Factors in Receiver." The subject, of great interest to VHF enthusiasts, ably dealt with and traced noise problems from the antenna right through the receiver.

A special committee has been appointed by the N.S.W. Division of the WIA to organise the most effective use and arrangements for the office building. It will be known as the "Administrative Building Advisory Committee" and the members are President Dave Duff, VK2EO, Max Pleffer, VK2MP, Ted Whiting, VK2ACD, Norm Beard, VK2ALJ, Tim Mills, VK2ZTM, and Bob Winch, VK2OA.

WIA broadcasts

SUNDAY mornings these days see a large number of active amateurs tuning to the various State Division's WIA broadcasts.

The dissemination of news each week permits amateurs, especially in the country districts of each State, to learn of the latest activity in Institute affairs besides information on the amateur service. The broadcasts are always well worth following by SWLs and intending amateurs. Here is a complete list of the broadcasts presented each Sunday morning.

New South Wales — VK2WI, 1100 hours, E.S.T. and presented simultaneously on 3575 kc/s, 7146 kc/s and 145.0 mc/s.

Victoria—VK3WI, 1030 hours, E.S.T. simultaneously on 3573 kc/s, 7146 kc/s, 51.016 mc/s and 146.25 mc/s.

Queensland — VK4WI, 0900 hours E.S.T. simultaneously on 7146 and 14342 kc/s.

South Australia — VK5WI, 0900 hours C.A.T., on 7146 kc/s.

Western Australia — VK6WI, 0930 hours W.A.S.T., 7146 kc/s.

Tasmania — VK7WI, 1000 hours E.S.T. simultaneously on 7146 and 3672 kc/s.

Slow Morse

DURING March the N.S.W. Division of the WIA recommenced their nightly Slow Morse Transmissions on 3535 kc/s. Individual amateurs conduct the sessions from their home locations in many parts of N.S.W. The transmissions commence at 7.30 p.m. and continue for half an hour. The worst of the static for the summer is now over and enthusiasts should find the morse of value in their endeavours to raise the WPM rating. Fuller details can be obtained from the N.S.W. WIA secretary.

Norm Beard VK2ALJ can be contacted by writing to the N.S.W. Division at 14 Atcheson Street, Crow's Nest. He will be pleased to supply details of the AOCP classes conducted at the above address and also by correspondence.

Lectures

FRANK HINE, VK2QL, was busy during February with lectures, his first at the meeting of the Hunter Branch in Newcastle and the second at the General Meeting of the Division in Sydney. His subject for both lectures was "Ionospheric Predictions" and it was a continuation of a previous lecture presented in August to the Divisional meeting. Frank will provide further information to members at a future discourse.

Urunga convention

EASTER will again see a big assembly of amateurs at Urunga for the annual convention of the WIA North Coast Zone, their 13th annual affair. A large number of visitors always attend this event, one of the most popular of the annual "get-togethers."

A comprehensive program of field events has been arranged besides social sessions for OMs and wives and kiddies.

Full information on the convention has been presented over VK2WI and Rod Pike, VK2ACU would be pleased to hear from amateurs that anticipate attending.

AWA RONETTE

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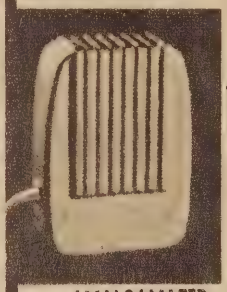

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RT24, TN, B/APX1 with 20 miniature seven-pin ceramic valve sockets and covers, chokes, etc.
45/- each

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with 0 to1 mill. meter, multi-switch red light, contactor, etc., £3/15/.
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BALL BEARING.
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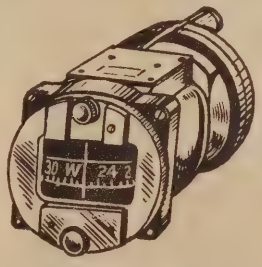

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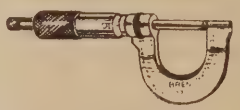

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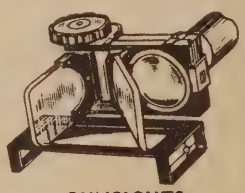

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New clubs

ANOTHER new Radio Club to be formed in the country is the Orange District Radio Society which already has 32 financial members. Norm Skulander, VK2JW, of 25 Franklin Road, Orange, would be pleased to supply information with reference to the society.

Col Fletcher, VK2ASF, of Bega is also considering with others the formation of a club in that area and would be pleased to hear from anyone interested.

VK Zero WH on 50.1 mc/s from Antarctica has been active daily and appears between 1200 to 1300 hours E.S.T. and again from 1700 to 1800 hours E.S.T. He uses CW mainly but can operate on telephony.

S.S.B.

VK4ZAX is understood to have made the first S.S.B. contact on 50 mc/s with JA1DLN. Quite a deal of interest in S.S.B. for that band has been created in JA. He contacted 80 JAs during the first 17 days in February.

VK2ADE reported the reception of DU1RC during a recent JA opening.

He was however lost in the mass of JA QRM.

Early in February VK5MK recorded a signal arriving from the north-west. It was very weak, but was identified as a KH6.

The JAs during February were also working with ZLs and Ws consistently.

Sunspot activity

Reviews of 50 mc/s DX working during the now waning sunspot maxima showed it to be the best period ever experienced.

Sunspots during the maxima (known as cycle 19) reached an all time high number level and records go back to 1750.

Cycle 18 provided the first true DX on 50 mc/s and Transatlantic contacts were made during 1946 and 1947. During the recent cycle similar contacts were made during 1956, 1957, 1958 and 1959 and there are good prospects that they will continue in 1960.

Shotput

OF more than ordinary interest to VHF amateurs was operation "Shotput" successfully carried out late last year.

A metallised balloon was fired into space and used for reflecting VHF signals. It was the first test of what will be an orbiting satellite capable of reflecting VHF and UHF signals over very long paths.

Many amateurs participated and a number of them made 15 second transmissions in sequence, aimed at the anticipated trajectory of the 100-foot sphere.

The group of amateurs participating were located on the U.S. East Coast and most reported positive results on 144 mc/s. Signals of varying characteristics were noted in cases showing approximately auroral distortion features. Some of the signals heard were over a 300 mile path. Similar test transmissions made on the 50 mc/s band were unsuccessful.

A number of rocket shots of the type are planned and an attempt will be made to put a balloon into orbit in March.

These will put balloons into the F2 region of the ionosphere in a north-east trajectory from Virginia.

DX certificate

A DX operating award that does not receive much publicity in overseas journals is the RSGBs Empire DX Certificate. Few VKs have qualified for the award to date. The first winner from Australia was Gordon Cole, VK2DI who qualified back in 1949. Since that date only four more VKs are listed. They are VK4HR, VK4FJ, VK3YS and VK2PV. The certificate is a beautifully prepared document, the finest of its type awarded.

Briefly the requirements for the award are as follows:—

Applicants must be RSGB members of three years standing. They must submit confirmations of contacts with 100 or more British Commonwealth call areas. Fifty of the contacts must be made on 14 mc/s, the rest on other amateur bands.

ARRL/CW contest

THE ARRL's 1960 W/VE DX CW contest produced quite a host of W and odd VE stations during the early evenings on 3.5 mc/s. During the first weekend signals were heard and worked by competitors from all parts of continent. From the East Coast came WIAW, official station of the ARRL, heard working, VK2GW and others. As could be expected from the sun spot business signals were more consistent and at better strength than during last year's contest.

Amateur growth

AMATEUR radio population growth in 1959 in the U.S. was at an all-time high level and the 200,000 amateur licence mark was passed late in the year. It is only eight years since the 100,000 figure was reached. The next 100,000 increase will not take anything like that period as the annual increase over the later period of the eight years was much greater. The U.K. amateur population stands at just over 8,000, with approximately 250 per year increase.

The greatest contribution to the growth in the U.S. comes from novice and technical class licensees.

Pirates

THE amateur movement in the U.K. has noted an influx of unlicensed stations on their bands. The position to date has never really become serious, according to an RSGB bulletin editorial. The ready availability of war-surplus gear has inevitably lead to unlicensed transmissions on amateur bands, the ex-Army type 19 set is rather popular. Unfortunately, bad enough as amateur band operation is, activity has not been restricted to those regions but due to drift, etc., they have wandered out on to marine guard stations.

A number of pirate stations have been located and operators fined. If the amateur movement is to keep its good name unmarred, amateurs must assist the authorities in locating these intruders. Here in Australia only on odd occasions does a pirate appear, it is to the amateur's advantage that his stay is short-lived.

Any youngster who has sufficient interest in the hobby to set up a transmitting station should have no difficulty in passing the AOCP or LAOCP examination.

Until so qualified he should curb his desire to operate and so break the law.

R. H. Oxford & Son Pty. Ltd.

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Mullard 2 Stereo chassis box in heavily plated dichromate steel, 40/ plus 25 p.c. S.T. Front plate printed with all graduations. 19/6. Stereo 2, wired and tested, £19/19/ plus 25 p.c. S.T.

R. and H. Low Input Stereo Preamp Box, heavily dichromated, 59/6, plus **25 p.c. Tax. Program Source Box.** Engraved front plate in burnished aluminium with dark red or brown figures, 40/, plus 25 p.c. tax.

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R. and H. Stereo Amp. Cabinet and Dichro. Chassis. £4/7/9 (gold), plus 25 p.c. tax.

TEST EQUIPMENT

R. and H. Sweep and Marker Generator case. All chassis printed front panel. £5/18/6, plus 12½ p.c. tax.

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R. and H. Bench type VTVM case chassis printed front panel, £2/14/, plus 12½ p.c. tax.

R. and H. Audio Signal Generator case chassis and printed front panel, £4/13/6, plus 12½ p.c. tax.

R. and H. RC Bridge case chassis and printed front panel, £3/4/6, plus 12½ p.c. tax.

R. and H. Audio Distortion Meter, case, chassis and printed front panel, £3/4/6, plus 12½ p.c. tax.

R. and H. Voltage Supply Regulator, case, chassis and printed panel. £4/17/6, plus 12½ p.c. tax.

Any of the above with Engraved front panel, £1/15/ extra.

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Engraved front panels for any of the above, 50/, plus 12½ p.c. tax; printed, 19/6, plus 12½ p.c. tax.

LET US QUOTE ON YOUR FRONT PANELS.

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- *Fast heating element, ready for operation in less than one minute.*
- *Exclusive design features resulting in universal acceptance of ORYX as the standard miniature soldering instrument.*
- *The ORYX long life element will outlast several bits which are of tight push-on fit.*

Bit Dia.:	Volts	Watts	Nett Weight	Length	Recommended Use
Model 6 1/16″ (Fixed)	6	6	0.25 oz.	6″	Electrical measuring instrument fine assemblies, hairsprings, R.F. pick-up and speech coils, hearing aid sub-assemblies, etc.
Model 6a 3/32″ (Push-on)	6	6	0.25 oz.	6″	As for Model 6 (for extremely delicate work only).
Model 9 5/32″ (Push-on)	6, 12, 24-27½	8.3	0.25 oz.	6″	Hearing Aids, Radio and TV Sub-assemblies, Coils, Electronic Instruments, Model Construction, Electro-Medical, etc.
Model 12 3/16″ (Push-on)	6, 12, 24-27½	12	0.5 oz.	6.25″	Radio, Television, and Telecommunications assemblies.
Model 18 3/16″ (Push-on)	6	18	0.75 oz.	7¼″	For heavier work, heat capacity equivalent to that of most 80 watt soldering irons.

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MSP3.58

ON SHORTWAVE BY ART CUSHEN

GOOD SIGNALS FROM WINDWARD IS.

The use of a relatively new frequency for the Windward Island Broadcasting Service at Grenada has resulted in excellent signals in this area.

STRONG signals from the Windward Island Broadcasting Service, which transmits from St. George in Grenada have been tuned in the mornings. The station is now using 15085 Kc and, as the transmission is beamed to the United Kingdom, signals in this area from the rear of the beam are very good.

The WIBS station has been relaying the recent cricket series between the English team and the West Indies. The frequency replaces the one of 17915 Kc, which was heard last winter at good strength at 7.00 a.m.

At this time the station identifies as "This is the Windward Island Broadcasting Service, St. George, Grenada. Listeners on medium wave can hear us on 1040 Kc in Kingston, St. George; in St. Vincents on 1570 Kc, in St. Lucia on 1580 Kc and on 1530 Kc. On shortwave on 5010 Kc in the Eastern Caribbean and on 15085 in the United Kingdom."

The station is heard from around 6 a.m. and fades out after 8 a.m., on 15085 Kc, a channel free from interference.

Biak on 6070 KC

THE transmissions from Biak in Dutch New Guinea have now been heard on the new frequency of 6070 Kc from sign-on at 7.00 p.m. The station commences transmission in Indonesian and, at 7.30 p.m., has been heard in Dutch.

The station was formerly on 5040 Kc and this new channel provides much stronger signals, though New Zealanders will find some sideband interference from Radio New Zealand on 6080, which is troublesome at times.

The station, which identifies as Radio Omroep, Nieuw Guinea, uses the power of 5,000 watts and has only been at this location for a short time. Its former broadcasts were made from Hollandia, when lower power was used.

The station verifies with an attractive card, which shows a map of New Guinea over which is superimposed a picture of a native bird.

Changes from Kabul

BROADCASTS from Afghanistan are subject to many changes, as the station's broadcasts seem to be of an experimental nature, with endeavours being made to get frequencies which give good coverage. The station has moved its relay of the Home program to 4750 Kc, which replaces 4710 Kc. The station has English to South-East Asia on the frequency from 1.30 to 2.00 a.m.

Further broadcasts in English for listeners in Europe have been noted on 9705 Kc, when signals are good in New Zealand. The time of this transmission is 5.00 to 5.30 a.m. and news is released at 5.05 a.m.

English from Delhi

BROADCASTS from All India Radio in Delhi in English are numerous throughout the broadcasting day, but the best received broadcasts are the ones beamed to Australia and to the United Kingdom.

Best reception from Delhi is listed below.

8.00 to 9.00 p.m.: To North-East Asia and China, 15205, 17705, 21615 Kc.

8.00 to 9.00 p.m.: Australia and New Zealand on 17785, 21690 Kc.

11.30 p.m. to 12.30 a.m.: To East Asia on 17705, 21605 Kc.

5.45 to 6.45 a.m.: To Eastern Europe on 11710, 9590 Kc.

5.45 to 6.45 a.m.: To West Africa, on 9555 and 11870 Kc.

Tunis on 9630 Kc

FOLLOWING our reception of the new Tunis station on 6125 Kc, reported last issue, the station has now appeared on the new frequency of 9630 Kc in the evenings. The 6125 Kc transmitter caused some interference to the B.B.C. transmissions up to 6.00 p.m., and it is presumed this was the cause of the change in frequency.

The new outlet of 9630 Kc gives good coverage. The broadcast is at its best at 6.00 p.m. when the station ends its Arabic musical program and, after an accordion band version of "Beer Barrel Polka," identifies in both French and Arabic.

Interference is heard from Radio Canada, Montreal, station CKLO, when it takes the air at 6.30 p.m. in its transmission to the South Pacific.

The Tunis station in the mornings has added sessions in French at 4.00 a.m. and English at 5.00 a.m.

Further information on the Tunis broadcasts shows that a new Foreign Service is now a regular part of its transmissions on the new 50 Kw station. The frequency of 9630 Kc uses Arabic with special transmissions from 3.00 to 4.00 a.m. and 5.30 to 6.30 a.m. During these times broadcasts are beamed to Egypt and Near East and the latter to Morocco.

From 8.00 a.m. Arabic is broadcast to Libya and Algeria, while foreign language broadcasts include 11.00 p.m. to midnight in French to the Mali Federation on 17805 Kc. From 4.00 to 5.00 a.m. the broadcasts are in English to Ghana and West Africa on 11855 Kc.

Tests from Monaco

RADIO MONTE CARLO is at present carrying out test transmissions, and these have been heard daily and on four frequencies, 9705, 11765, 15380, 17855 Kc. The station is on the air with tests from 3.00 to 3.45 p.m. and from 8.00 to 9.00 a.m. The station uses 9705 and 11765 Kc in chain, and on alternate days is testing on the other two frequencies in parallel.

The station is also carrying out tests in the 41-metre band when, from 7.10 to 7.50 a.m., a religious broadcast is carried on both 7132 and 7140 Kc.

The recent announcement of the construction of new stations in Monaco following the closing of the Tangier broadcasts IBRA and WTAN, is presumed to be the reason for the tests, which are to be now used by the former North African broadcasters.

Kozani on 7950 Kc

SEVERAL New Zealand listeners report the reception of the Forces Broadcasting station in Kozani, Greece, using 500 watts on 7950 Kc. The station has been tuned on Sundays at 4.15 p.m., when a news session in Greek is carried.

At 4.30 p.m. following identification the station has a relay of morning church services. Broadcasts from the station are scheduled to be on the air from 3.00 to 5.00 p.m., 8.00 to 11.00 p.m. and 2.00 to 6.30 a.m.

Reports on the transmission of this station, together with the other Forces stations in Greece should be sent to the Forces Broadcasting Station, Central Broadcasting Station, Athens, Greece.

Peking using 3950 Kc

BROADCASTS from Peking in English on the lowest short-wave frequency yet observed in the broadcasting from Peking has been noted on 3950 Kc. The station is heard at good strength in the mornings, and at 4.00 a.m. presents a session of English comments and sidelights on China to 4.30 a.m.

FLASHES FROM EVERYWHERE

PERU has a new noncommercial shortwave broadcaster; this one operated by the University of Arequipa is using 6330 Kc.

FRENCH GUIANA station Radio Cayenne is again to be heard in this area from sign-on, using the frequency of 6170 Kc and a power of 1000 watts. The station is on the air 8.15 to 9.15 p.m., 2.40 to 3.45 a.m., and 8.30 to 11.00 a.m. daily.

MARTINIQUE which has not been heard in this area for at least 15 years, is now on a new schedule, which is suitable to reception here. The station uses 1,000 watts on 5994 Kc, and is broadcasting from 8.15 to 9.30 p.m., 2.15 to 3.45 a.m., 8.30 to 11.25 a.m. In addition a transmitter of 8,000 watts is using several frequencies on an experimental basis, 8.15 to 9.30 p.m. on 3315 Kc, 2.30 to 3.45 a.m. on 4895 Kc, and 8.30 to 11.25 a.m. on 2420 Kc, according to the World Radio Handbook.

ANGOLA has reported that Radio Clube de Congo Portuguese is heard on 4795 to sign off at 9.00 a.m. The station identifies at 7.59 a.m. as "Radio Clube de Congo Portuguese de Cormona."

7 STORES

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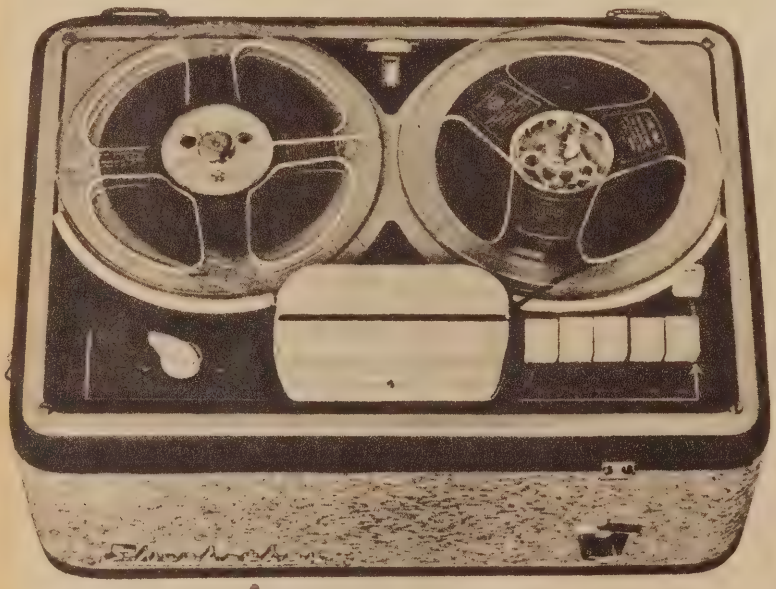

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Outputs: Monitor, Ext. L.S. (3 ohm).
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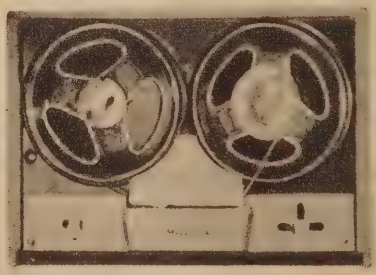

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GUATEMALAN station on 6230 Kc heard in the afternoons has now moved to 6250 Kc, and identification of the station is contained in a verification received by a listener in North America. The station is Radio Tical Ciudad Flores and uses the callsign TGRT.

INDONESIAN Radio RRI at Denpaser in Bali has appeared on 7118 Kc. The station is broadcasting from 7.30 p.m. to 1.30 a.m.

IRAN with broadcasts over Radio Teheran are soon to be heard on a 24-hour a day basis. The present transmissions from the Home Service of Radio Teheran is on 3780 and 7288 Kc and 9680 Kc. These stations are heard at dawn and best signals are on 3780 Kc with news in Persian at 3.30 a.m. The Foreign Service from Radio Teheran is on the air on 9660 Kc, with Turkish at 6.00 a.m., French 6.15 and English from 6.30 to 7.00 a.m.

JORDAN is testing from Amman over the Hasimite Broadcasting Service on 11810 Kc from 5.00 p.m.

MALAYA is heard on the new frequency of 6015 Kc from 7.30 p.m. to 1.30 a.m. in English. Singapore has also taken the old 4720 Kc frequency back into use.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern time.

PHILIPPINES, which has made exceptional progress in radio in recent years, and now boasts 62 medium wave stations, is reported with a new short-wave relay. The station is operated by the State University of the Philippines at Quezon City, on the air from 7.00 to 11.00 p.m. each day except Sundays. The stations are DZUP on 1580 Kc on broadcast band and on 7240 Kc with 250 watts. All programs are in English, except Tuesdays, when Tagalog is presented from 7.30 to 8.00 p.m.

MAURITIUS, now using new equipment, has verified with news that the new schedule is used from 1.00 to 2.15 p.m. on 6101 Kc, and from 12.30 to 3.30 a.m. on 3325 Kc.

SEOUL is reported from California in a new transmission which is heard from 5.30 ot 6.30 p.m. on HLK7 on 15258 Kc. The station of the Korean Broadcasting System has news in English at 5.30 p.m. and in Korean at 6.00 p.m.

Another Korean station which was on 11920 Kc, and has the callsign HLK6, has moved to 11740 Kc. This station is on the air from 2.00 to 3.00 a.m., and as the frequency is also used by Radio Australia both stations suffer considerable interference.

CAIRO is giving good reception in Victoria according to Arthur Harris in Melbourne, who hears them with dictation speed news at 4.30 p.m. The station gives good reception at this time, when a news bulletin in English at dictation speed is presented.

MAURETANIA in West Africa has an experimental transmission from 5.00 p.m. to 5.35 p.m. The station uses 9610 Kc and opens the broadcast with a drum beat, and then identification in French. The station suffers interference from VOA on 9615 in Tangier, and reception is reported by a North American listener.

TEL AVIV was scheduled on April 1 to commence a new service with broadcasts directed to Africa. The Israel station is to use 11845 Kc. a frequency on which it conducted test broadcast last year. The station plans to use several languages including English and Swahili in the service. In Tel Aviv, work is progressing on a new 250,000 watt transmitter, which will be used on broadcast band to carry the Arabic broadcasts from Israel to its Near East neighbours, reports a correspondent to Radio Australia, who lives in Israel.

LUXEMBOURG has introduced a new frequency, reports the Swiss DX program; the station has relays of the Luxembourg I program on 7110 Kc. The station uses this frequency from 6.00 p.m. to 4.00 a.m. The Luxembourg 2 program is still heard on 6090 Kc, but has some considerable interference from Sydney station VL16 using the same frequency, but is heard free from interference before 6.00 a.m.

LEBANON with broadcasts from Beirut has cancelled its French programs and these are replaced by Arabic broadcasts.

Beirut is heard at 5.00 a.m., the station uses 8010 Kc., and has been heard 2.00 to 6.15 a.m. with weak signals.

ISRAEL transmissions on 9009 Kc. continue to be well received. The station between 2.00 and 2.30 a.m. has English to Africa and from 6.30 to 7.00 a.m. a program in English is broadcast for the United Kingdom.

Israel also has programs in Yiddish, Afrikaans, Persian, Roumanian, Russian, Polish and Hebrew. Before 3.00 a.m. the frequency of 9009 Kc. only is employed but, after this hour, the additional frequency of 9727 Kc. is put into service.

BRAZZAVILLE for its African broadcasts from the Congo Republic is using a new frequency, 9780 Kc. and, with 5970 and 11725 Kc. is on the air with English from 4.10 a.m., French Portuguese lessons at 4.30 a.m. and news in Portuguese at 4.45 a.m. News in French is then carried at 5.00 a.m.

HAITIAN station 4VEC which has been off the air due to power trouble has returned to its frequency of 6000 kilocycles, and has been heard at 8.15 p.m. at fair strength. The station which identifies as "This is Radio 4VEH the Evangelistic Voice of the West Indies, and radio voice of the Oriental Missionary Society broadcasting from Cap Haitian Haiti." This station at 8.15 p.m. has been heard with "Back to the Bible" broadcasts. The station is reported to be working with 4VWI, which uses 9770 Kc. at the same time.

MEXICAN station XEOI which is not a regular signal in this area, has recently been heard consistently on 6010 Kc. to sign off at 4.00 p.m. The station closes with "Ave Maria" and then identifies as "Radio Mil XEOY and YEOI" together with frequency details and leaves the air after the playing of a few bars of piano music. XEOI relays XEOY and both stations are located in Mexico City.

BELGIAN CONGO has a transmission to listeners in Europe and this is broadcast on 6295 and 9385 Kc. The transmission is on the air from 1.30 to 7.00 a.m., and on Sunday and Monday the broadcast is extended to 8.00 a.m. The station has news in French at 4.30 and 6.50 a.m. and in Flemish from 4.00 a.m. and again from 6.55 a.m.

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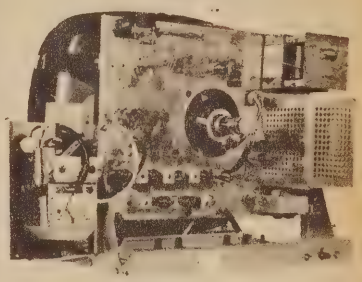

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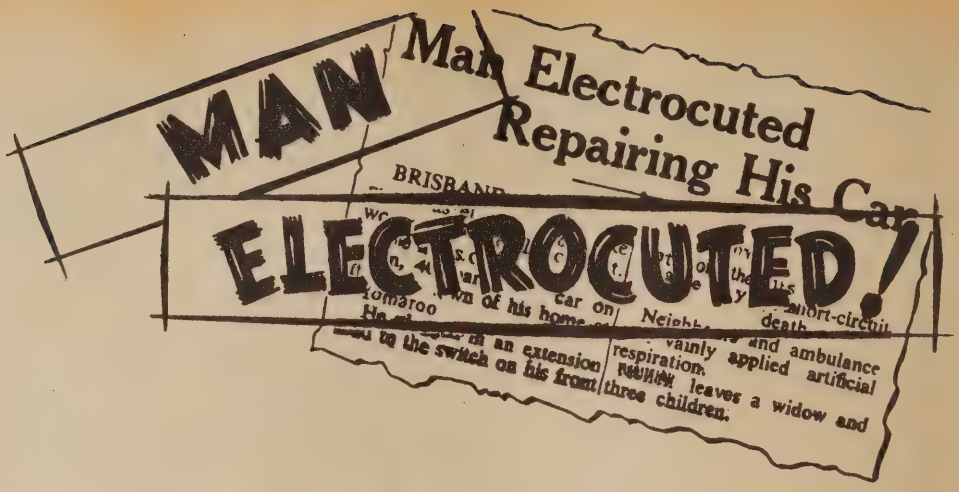

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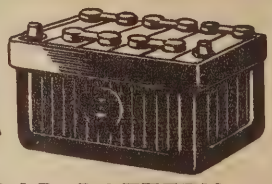

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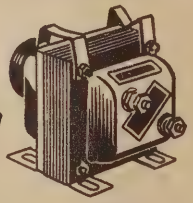

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ELECTRONICS BUILDS NEW ROADS

(Continued from Page 7)

motorist's trip is speeded and townspeople are given relief from dangerous congestion caused by a mingling of through traffic and local traffic.

There will be no intersections and no driveways—and no traffic lights. Lesser highways and local roads will be carried over or under the freeways.

Access will be barred at all but a relatively few places. To get on or off the freeway, motorists will use access roads which permit safe merging with through traffic by means of a speed-change lane. Exits will operate on the same basis.

ACCESS POINTS

Access points will be placed where traffic requires them, but for safety they will be at least one mile apart. This means that traffic will have sufficient time to merge smoothly.

At big cities, through traffic will be carried on "ring" roads (which will be known as Interstate Belt Highways). At the edge of the city, motorists will have a choice of switching to the ring road or following the freeway into the heart of the city. Large cities will have many freeways leading in from different directions.

It is expected that the super highway system will reduce the traffic toll by one million accidents a year—and save 4,000 lives a year.

Everything connected with this new highway system is on a colossal scale. Engineers point out that road-building is now so complex that one structure like a large traffic interchange may require the best part of 40,000 separate computations. Enormous files of statistics must go to the computers as a basis for such work.

Every phase of highway planning now comes under this intensive study—even the comparison of different contractors' tenders.

Used in this way, electronics can release men from time-consuming drudgery. The answers that are thrown up are astounding in their diversity. The expert can find out to a decimal point such varying facts as distances, grades and excavation details—or the cost of the grass seed needed to sow a bank.

ENORMOUS SAVING

With surveyors and engineers working entirely from the ground, it takes about two and a half years to study local road location before construction of a new highway may begin. Now aerial photography and electronics are brought to the service of the experts, and today's highway engineers can take short cuts—in method as well as in the map.

They use machines called geodimeters and tellurometers which direct microwaves at features of the landscape up to 40 miles distant and translate the returned impulses into miles, yards and inches.

By taking a great mass of aerial pictures, each from a different angle, it is possible to feed the information to computers which provide the information on which to construct contour maps revealing the exact height of every feature from a hill to a boulder.

The U.S. highways are being designed to provide a minimum visibility, even in mountains, of 1,000ft ahead. Engineers construct curves and gradients that are not only easy to drive but create pleasing vistas.

Land clearing is practically the sole remaining activity that requires much manual labour. When the trees have been removed and the undergrowth cleared, the field can be left to the machines.

Then begins the long parade of great shovels, scrapers, rippers, loaders and graders. Following the lines of stakes the engineers have left, the operators begin the process of cut-and-fill, removing soil and rock from high places and piling up earth in the low.

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The contrast between the road-building of former ages and today's procedures is striking. The biggest scraper-loader now in use is able to do the work of 1,000 men with picks and shovels.

Each time the machine takes its gigantic "bite" it gulps up 35 tons of earth—enough to fill a fair-sized room—and delivers it downhill at 30 miles an hour.

There is a delicacy of handling needed to bring out the best of the monster machines. A bulldozer operator can run his machine time after time up a high bank, then down at a dizzy speed, so that the blade and the weight of the heavy treads finish the embankment cleanly. With a small amount of hand-raking to remove the marks of the treads, the bank can be sown with grass seed.

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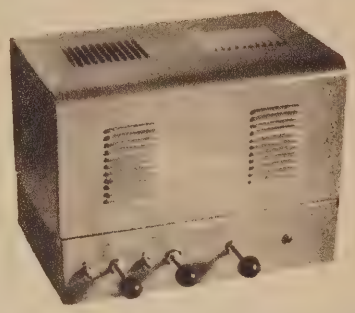

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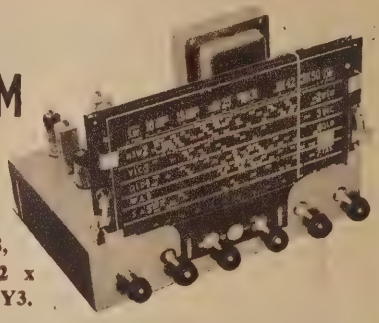

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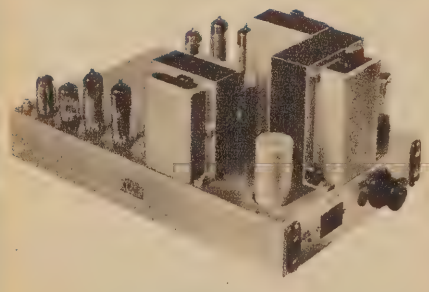
Extract from Test Report by J. C. G. Gilbert reprinted from the Music Trades Review, February, 1959.



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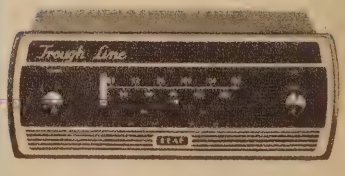

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ANSWERS TO CORRESPONDENTS

D.A.H. (Perth) inquires about the transistorised ignition coil described in the January issue, and if these units are available in Australia.

A.: The article concerning automobile electrical systems was supplied from an overseas source, D.A.H., so no further information is available concerning its contents. However, to our knowledge, no coils of this type are as yet available in this country.

V.E. (Centennial Park, N.S.W.) is puzzled by the fact that his portable receiver, when operated from the mains, responds immediately it is switched on, without any warm-up period.

A.: Without any knowledge of the circuit, V.E., it is hard for us to comment. However, the only item normally requiring a warm-up period is such a set is the rectifier, but a number of designs have used dry rectifiers in this application, and so no warm-up period would be needed.

D.R. (Ballarat, Vic.) sends us a circuit of a Vibrato unit for a guitar amplifier. He has been unable to make it work and asks if we can help him.

A.: Unfortunately, D.R., we have never tackled such a project so there is no article to which we can refer you. We also regret that we cannot devote time to the analysis of readers' circuits and their associated difficulties. It is, of course, doubly difficult to comment on these problems, when we do not have the equipment referred to for inspection in our own workshop.

W.F. (Bendigo, Vic.) wants to fit a ferrite rod aerial to the Three Transistor Set of March, 1959.

A.: We have never described such an arrangement, W.F., and so we regret we cannot help you. In any case, we feel that this form of operation would be asking a lot of such a simple set, and results are likely to be disappointing except in very strong signal areas.

J.C. (Morpeth, N.S.W.) forwards a fee to cover a previous query and submits another query which he feels may be of general interest. This concerns the probable harm resulting from playing 45 r.p.m. records at 33 r.p.m.

A.: The fee you enclosed is duly acknowledged, J.C., and we trust the information was helpful to you. In regard to the record speeds, you are quite correct in saying that the stylus size, groove shape, pressure and other standards are identical for both systems, and that there should be no objection on this score. The most likely difference concerns the acceleration of the stylus in a lateral plane and this would be slightly less at the reduced speed, and so would, if anything, be more favourable in regard to record wear. However, the difference is not likely to be significant in practice. The change in speed would make no significant difference to downward pressure of the stylus.

T.J. (Gumdale, Q.) writes to notify us of a change of address and to comment on the magazine generally.

A.: Your change of address has been forwarded to the appropriate department, T.J., and all further copies will be forwarded to it. Many thanks for your comments about the magazine and we are glad you find it so interesting. In regard to a separate "Serviceman" series on TV, we feel that the present series covers this aspect of servicing fairly adequately, and that it has struck a reasonable balance between radio and TV problems. However, we are always grateful for any suggestions which readers care to make about the magazine.

A.B.W. (Auckland, N.Z.) writes comment on the magazine in general and the new printing process in particular. He refers to a series of articles published some years ago on oscilloscopes and the uses for the instrument and suggests that something along these lines might be repeated. Finally, he appears to be looking forward to TV in New Zealand with mixed feelings!

A.: Many thanks for your comments and kind thoughts, "A.B.W," and these will be passed on to the person concerned. You may be sure they will be appreciated. We are glad to hear you like the new presentation and we hope it will be a success. Thanks also for the suggestion regarding the articles, and we will keep this idea in mind. We feel sure you will find TV more "good" than "evil," though we suspect you mean that last word in the technical rather than the social sense.

G.K. (Pymble, N.S.W.) writes to suggest that it is some time since we described an elaborate communications receiver. He points out that there are now commercial tuners available for this purpose and suggests that we consider a project of this kind.

A.: Many thanks for your comment and suggestion, "G.K.," and we will keep this idea in mind. Unfortunately, we cannot make any forecast at this stage as to when this might be.

N.B. (Scarness, Q.) sends us a circuit of a proximity relay which he has built and suggests that it may be of use for the Reader Built It section.

A.: Many thanks for the contribution, "N.B.," and we will file this for possible use as you suggest.

J.S. (Leongatha, Vic.) writes to report reception of ABQ Channel 2, Brisbane, on January 7, using the normal aerial employed for local reception and which may not even be correctly orientated. He also reports having built the Three-Band-Three and of having successfully received a number of overseas stations, as well as the Two Transistor set of January, 1959.

A.: Many thanks for the various reports, J.S., which are very interesting. Your problem concerning the regeneration of the transistor set would appear to be due to resonance of the aerial at certain critical lengths and which can so load the detector that it will not oscillate. A small variable capacitor, three or five plate type, in series with the aerial is often used to permit adjustment which will allow oscillation.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

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M.J.A. (Albury, N.S.W.) wants to know if we have circuits for transistorised two-way radios suitable for taxis, etc., or whether kits for these can be purchased.

A.: We have no circuits, M.J.A., and we know of no kits available for this purpose. Some of the companies producing these systems commercially are experimenting with transistorised versions but we do not know if they are available at the present time.

N.A.McP. (Toowoomba, Q) has built a multi-vibrator and wants to know how to use this for receiver alignment.

A.: The multi-vibrator was intended mainly for adjustment of the padder circuit on the broadcast band and the aerial and oscillator trimmers on the short-wave band; operations which frequently require continual retuning of the set. Its use was justified by the simplicity of the device. It is not suitable for IF alignment except in a most elementary form. These points were covered in the original article.

We have available a pamphlet on alignment procedure which may give you a better idea of what is required for this operation.

We are not quite sure what you require in regard to the "output condenser" but we assume you refer to a fixed value of top cut filter. If this appears inadequate, larger values may be tried and selected experimentally.

H.W.P. (Roma, Q) forwards an annual subscription and offers a few comments about the magazine. He also encloses a query concerning birdies in a short-wave set, apparent only when the local station is operating.

A.: Many thanks for your subscription, which has been forwarded to the appropriate department. An official receipt will be issued directly to you. We note your comments about the magazine, and particularly concerning the index. We may be able to do something about this soon if time permits.

While it is difficult to work out the exact figures it seems most likely that your local station (or harmonics from it created within the receiver) are beating with the local oscillator or harmonics from it.

It might be worth while checking the intermediate frequency and even try shifting it slightly. However, we feel that the most satisfactory approach might be to fit a wave trap tuned to reject the local station.

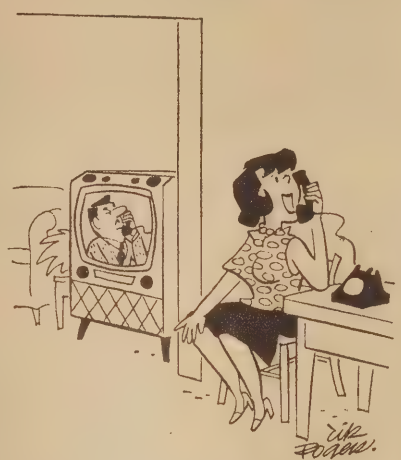
This can be a simple parallel-tuned circuit using (say) a modern aerial coil secondary winding and a trimmer, connected in series with the aerial lead. When tuned to the local station frequency it will attenuate its strength considerably without affecting other signals to any worthwhile degree.

R.O. (Narromine, N.S.W.) says that he has built a crystal set and used a crystal earpiece for the phones. This was very successful. Then he built the One Transistor Amplifier, from the April, 1957, issue, and again used the crystal earpiece. This time it did not work but does work when ordinary earphones are substituted.

Why is this?

A.: The crystal earpiece is just not meant to work in this position. Firstly, it is not supposed to pass DC. When it is connected in the collector lead, in the manner of the amplifier, the DC to the collector, as well as the audio signal, has to pass through it. If the voltage applied is too large the crystal will be damaged, though in this particular case this has probably not happened.

Secondly, and apart from the DC problem, transistors are in general low impedance devices and a load as high as that which the crystal would present would be most unsuitable. Ordinary headphones, on the other hand, have quite a low DC resistance, so the transistor can operate at maximum efficiency while the AC resistance, across which the audio signal is developed, is nearer the optimum value for maximum output.



"Our new set arrived, dear. It gets colour, black-and-white, UHF, AM-FM, shortwave and who knows what else!"

A.R.K. (Ashburton, Vic.) wants us to describe a transistorised electronic flash gun.

A.: Many thanks for the suggestion, A.R.K., and we will keep this idea in mind. However, there are a number of snags, including the availability of suitable components and the limited performance possible with most current types.

R.S. (Wooloowin ,Q) has recently built the One Transistor Regenerative Set described in the December, 1958, issue, and is very happy with the performance.

Many thanks for the report on this set, R.S., and we are very happy to learn that it is performing so well. We will keep your ideas in mind regarding the case and the aerial.

N.C.D. (North Collie, W.A.) is anxious to use an existing power supply for the Standard Radiogram of May, 1957, but is worried about the fact that it uses a choke filter system in place of the simpler resistor system we used.

A.: There is no objection to using the alternative power supply provided it gives the same voltage output and is capable of delivering the required current. It may be possible to modify some of the decoupling networks without increasing the hum level seriously, but this would be best determined by experiment. However, we can assure you that this form of power supply is a perfectly practical one and you should have no difficulty in obtaining the required capacitors from our advertisers.

K.B. (Fairfield, N.S.W.) is one of our long-established readers who recalls some of the incidents and components which were popular in years past. However, he is still active and is at present interested in the meter protection idea described in recent issues. He proposes to use it on an existing high quality commercial instrument.

A.: Many thanks for your comments, K.B., and we well recall some of the circumstances you describe. We can see no reason why the protective scheme cannot be used for your multimeter, although it would be necessary to study the circuit in detail in order to be sure that no other modification were necessary, or that any complications might arise. However, if the points made in the article are followed this should not present a problem.

Many thanks, also, for the suggestions and we will keep these ideas in mind for possible use in the future.

D.B. (Nanango, Q) would like to see us run a beginners section in the magazine.

A.: Many thanks for the suggestion. D.B., but we feel that the number of beginners articles which we publish now is about as many as the magazine can stand without sacrificing some other subjects. As it is, other readers sometimes criticise us for publishing too many of these, and we have to try to strike a reasonable balance between all sections of our readers. However, you may rest assured we always have the requirements of the beginner in mind.

K.C.K. (Reservoir) asks if we intend publishing details for a Tesla coil in the near future.

A.: Due to the very limited demand for such a device, K.C.K., we have no plans at the present for high voltage equipment of this type. We appreciate your interest in the magazine, but we regret being unable to help you, at least for the present.

G.H. (Largs Nth., S.A.), inquires about an electric guitar, with particular reference to the structure and woodwork of the instrument itself.

A.: Apart from the series of articles which appeared late in 1941, G.H., we have not published details of the mechanical portion of such an instrument. We have, however, published details for the electoronic amplifier which is used with such instruments, the most recent being in the December, 1954, issue.

N.G. (North Melbourne, Vic.) has a query regarding the addition of a control unit and tuner to our low-cost crystal amplifier.

A.: The additions you speak about are quite feasible. The Playmaster control unit for crystals is a suitable unit to add. Any of the tuners we have featured in the past are also suitable. The existing power supply in the amplifier will not, however, be able to cope with the additional drain of a tuner and a separate or enlarged power supply will be essential. The recently described program source, with a built-in power supply, should be ideal for this purpose. Alterations to the amplifier would consist mainly of the deletion of the controls in the input circuit, the lot being simply replaced by a fixed grid leak of 1 meg. Circuits and probably the original issues are available through our query service, the former at 2/ per three circuits and the latter at 2/6 per copy.

S.C. (no address) comments on a recent editorial about other planets and possible inhabitants thereon.

A.: Thank you for your letter. We are aware of what you have in mind, but there are naturally plenty of people who won't agree with you. Thanks for your kind wishes.

SALE OF RADIO COMPONENT MANUFACTURER'S SURPLUS STOCK

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Aerial Coil, ¾in square can bakelite paper former	4 9
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R.F. Coil, ¾in square miniature can, polystyrene former	5 3
R.F. Coil, ¾in square miniature can, bakelite paper former	4 9
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Miniature oscillator coils in ¾in square can for 6AN7 valve	3 5
Miniature oscillator coils in ¾in square can for 6A8 valve	2 9
Miniature oscillator coils in ¾in square can for IR5 valve	2 6
Miniature oscillator coils in ¾in square can for 6BE6 valve	2 3
I.F. transformer for 455 kc/s in 1 3/8in round can. Special High Q	7 3
I.F. transformer for 455 kc/s in ¾in square can, Universal, type 119	4 9
I.F. transformer for 455 kc/s in ¾in square can, high gain, type 14	6 9
I.F. transformer for 455 kc/s in ¾in square can, diode detector, type 15	5 11
Power transformer for Mantel radio and small amplifiers, type 112 — (240V; 6.3V; 6.3V C.T.; 2 x 180V; 50.mA)	16 3
Power transformer for instruments, type 326 (240V. primary; 6.3V; 1A, 150V; 15 mA)	12 6
Power transformer for amplifiers, type 324 (240V. primary; 6.3V; 3A, 300V C.T.; 100 mA)	1 18 0
Isolation transformer for American instruments and radio, 240/110V, 150W, Type 380	2 5 0
Low voltage transformer, 240V, primary 4V; 2A Secondary; C.T., Type 103A	15 9
Low voltage transformer, 240V. primary; 8V; 1A Secondary; C.T. Type 104A	15 9
Type 103-6 volt vibrator transformers	15 9
Type 104-12 volt vibrator transformers	15 9
Type 109-32V/240V invertor transformers	15 0
Potentiometers, Dual; Concentric 1000 ohm. over 500,000 ohm. with outer spindle 1in and inner spindle 1¼in fitted with 250V 10a D.P.S.T. switch	13 3
Potentiometers D.P.S.T. 500,000 ohm with 1¼in spindle	5 0
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18in	6 3
22in	6 7
25in	6 9
38in	8 3
Connectors fuse flanged complete M.F.	8
Hookbolts, ¼in steel with 2½in thread and plated	10
Knobs — Type MV6 Grey	7
Rubber Channel — suit ¼in width materials (ft)	6
Sockets — valve or vibrator 6 pin with circlip	1 2
Cloth — suit radio speaker grills, colour blue	9 6
Connectors — microphone cable M & F complete	11 6
Dials: Hub moulded on brass boss, 2¾in diameter x 3/8in bore	3 11
Dials: Hub cast gunmetal 2in diameter x 3/8in bore	1 6
Potentiometers, 1 meg. ohm non switch 1½in spindle	2 7
Plugs — 4 pin miniature	5
Washers — canvas bakelite insulating ¼in I.D. x 7/8in O.D. (doz.)	1 5
Transformers and Coils for TV Receivers.	
Power transformer for TV, silicon diode voltage doubler, type 329 — 240V; primary, 12.6V C.T. 6A; 125: 600 mA.)	2 18 0
Filter choke for TV and amplifiers, 300 mA 1H. Type 817	10 0
Vertical output transformers 110 deg. for Philips yoke, Type 443	19 10
1st Video I.F. with 30.5 Mc/s trap. no can, type 943	8 6
2nd and 3rd Video I.F. no can, type 941	8 1
Video Detector Coil, 7/8in sq. can, type 945	9 9
Sound Take off transformers 5.5 Mc/s T206 in 7/8in sq. can	10 3
Ratio Detector: T102; 1 3/8in sq. can with matched pair of Germanium diodes, filters, and so on	16 4
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I.T.U.—HOW THE AMATEURS FARED

(Continued from Page 129)

Firstly, we must obtain a much greater sense of Federal responsibility from the ordinary Amateur and from the Divisions. At the moment, this sense is at its lowest ebb and has been for years.

Coming straight from Geneva, where our very future was being battled for, I was astounded and discouraged to find that Divisions had voted against holding a Convention this year.

At the very time when our future and past organisation is of primary importance, the Federal Council was not to meet, apparently because it couldn't think of anything important enough to discuss.

We must find Councillors and Divisional leaders who have much wider vision than this. All our excellent, and often elaborate, Divisional set-ups will be of little use if we haven't the bands to use them.

Secondly, we must evolve a Federal set-up which will work, which will attract Councillors of high standing and experience who can tackle the job of improving our own standing and priority in the communications world.

NOT DOING ITS JOB

At present the Federal Council isn't doing its job, and the Federal Executive has become exhausted trying to cope with an almost impossible situation.

I am not intending here to supply a set of answers to this matter, which is an ideal item for a Convention if ever there was one.

But I do say that unless we are prepared to solve the problem, and to spend money doing it, we can't blame F.A.S.C. or anyone else if they overlook Amateur claims because we are inadequately organised to handle them.

To my mind it is an urgent and critical situation.

I must conclude my report at this point. I suppose we must always regard a conference involving losses as a failure, but I believe that, in the circumstances, we have a great deal to be thankful for.

At least I did the best I could to help bring this about.

I believe that every Amateur who tacks his licence to the wall must shoulder an inescapable responsibility to his fellow Amateurs and to the Amateurs of the future. If he fails them, they must suffer and may even cease to be.

Please think about this, for it is the key to everything that I have written here.

AMATEUR 'FEAT'

Two 17-year-old American amateurs have reported the world's first successful two-way radio communication aided by artificial satellites.

Raphael Soifer, of New York, and Perry Klein, of Bethesda, Maryland, told the Massachusetts Institute of Technology they had exchanged coded signals on February 6 by bouncing them off the ionised trails of U.S. Explorer VII and Russia's Sputnik III.

Dr Jerone Weisner, director of the Institute's electronics research laboratory, said he had verified the youths' claims. He praised their "imagination and initiative."

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Two Input Channels: (1) high gain, high impedance for microphone, home radios, TV sound and disc pick-ups; (2) radio tuner input.

Microphone: High sensitivity type to attach to standard microphone stand.

Speakers: Two specially matched 6in A.W.A. loudspeakers for high-fidelity reproduction.

Dual Tone Controls: Two separate controls are included, allowing complete and independent variation of treble and bass registers.

Rev. Counter: For forward and reverse directions; immediate location of any subject matter on tape. Turn knob anti-clockwise to reset at zero.

Fast Rewind: Simple lever control, rewinds full spool in 85 seconds.

Fast Forward: Simple lever control, winds full spool in 95 seconds.

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Public Address: Position on function lever fits Magictape for public address unit or portable amplifier with extension speakers.

Foot Control for Stenography: Screw-in socket for control in front of case.

Weight: 34lb.

Size: 15 5/8in x 14 5/8in x 9½in.

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Brand-new, imported P.M.G. type phone plugs. A good buy at this price.

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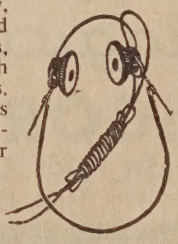
CRYSTAL SETS

Compact 4 x 2½ x 2¼in metal cabinet coloured blue with black and gold tuning dial, using a germanium diode, detector and slug tuner. The crystal earpiece or headphones illustrated below are suitable for use with this set

Postage 3/6. **39/6**

HEADPHONES



Brand - new, imported headphones, complete with leads and tips. 4,000 ohms high impedance. Ideal for crystal sets.

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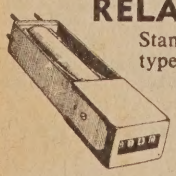

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Here is a powerful, precision, imported instrument ideal for students, etc. These are not toys, but give magnification from 80 power to 600 power through twin eyepieces coupled with three objective lenses. Optional reflector or built-in light to illuminate slide; complete with three slides and supplied in a wooden carrying case.

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0-5 Amp. AC/DC 3⅜in 62/6
0-20 Amp. AC/DC 3⅜in 62/6
0-30 Amp. DC 3⅜in 62/6
0-50 Amp. AC/DC 3⅜in 62/6
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1C7	7/6	7C7	2/6
2X2	6/9	12C8	10/6
1A5	7/6	12A6	7/6
1D4	6/6	12J5	10/6
6AC7	2/9	12K8	9/
1J6	7/6	12SC7	12/6
6A8G	9/6	12SH7	9/6
6G6	12/6	12SJ7	12/
6J7	4/9	12SR7	7/6
6AG5	6/9	807	11/6
6J5	8/6	809	19/6
6L7	12/6	815	29/6
6N7	9/6	830B	10/
6R7	12/	954	1/6
6SC7	12/6	958A	1/11
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THERE WAS NO TIME

(Continued from Page 23)

a small segment of the pendulum's arc is like the long side of a right-angled triangle. They liken the weight, swinging through that arc, to a ball rolling down a similar incline—the aforesaid long side of the triangle.

They work out figures of acceleration; they compare the ball's ultimate speed with what it would achieve in falling through the same vertical distance; they show that, though longer arcs involve greater distances, the slope is correspondingly greater; finally, that the greater distance which the ball has to travel is exactly offset by its greater acceleration and speed.

Reverting from free rolling balls and triangles to the pendulum, it is deduced that the same thing takes place. When the swing is greater, the pendulum has further to travel, but it accelerates faster and reaches a higher speed.

CURVED PATH?

There could be an objection to this by saying that curved paths being longer than straight paths between the same points, the action of the pendulum could introduce errors. The truth of this is compensated for by the fact that accurate pendulums are never allowed to swing in wide arcs, so that the difference between the straight and the curved paths is negligible.

The best clocks always have pendulums with a small swing and a pendulum taking three seconds to swing from side to side and which is 88 inches long shoudl swing no more than one and a half inches each side of centre.

Incidentally, the exact length of a pendulum for a given time of swing varies slightly for different parts of the earth, because of variation in gravitational pull.

Pendulums can be made very accurate indeed, various devices having been invented for compensating for changes of temperature effects on the metal bob and other apparatus connected with it.

A pendulum is kept swinging by giving it a mechanical push every few seconds. At the top of the pendulum is the escapement mechanism, which is operated by the swinging pendulum. This is illustrated in another diagram.

MOST ACCURATE

The most accurate clocks in the world today are operated by pendulums. Some of these are accurate to one part in 300-millions of the time measured. In one year of untouched running, these clocks will give the time to one tenth of a second at any hour of the day.

Of course, there are what are known as "atomic" clocks and quartz crystal clocks, the latter making use of the electrical properties of quartz crystals for their operation. These give an accuracy of one part in 1,000 million, which seems to contradict the statement that pendulum clocks are the most accurate in the world. But the quartz crystal clock from the clockmaker's point of view is really an electrical scientific instrument.

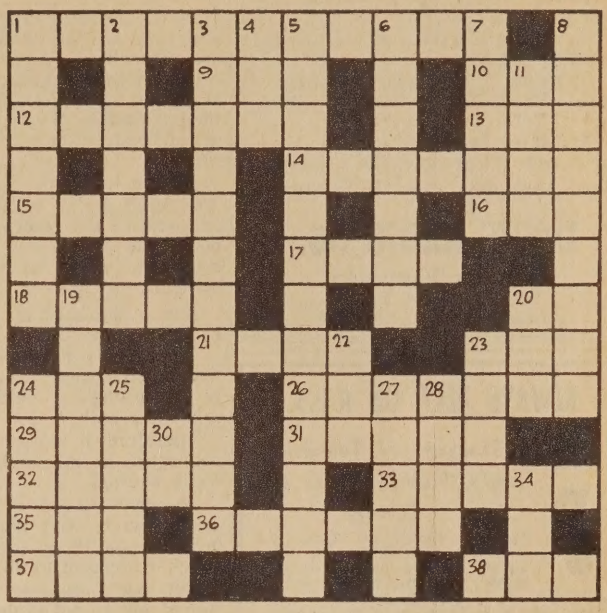
Testing of clocks and watches has been brought to a fine art and those who think that they have the perfect timepiece may get quite a surprise if the same piece were tested on latest equipment.

In addition to complicated electronic equipment, which space does not permit of description, there is a system which registers impulses on moving graph paper.

In this apparatus, a cylinder carries a long roll of paper and is rotated at an exact controlled speed of 300 revolutions per minute, by means of a tuning fork. The locking of the lower pallets of a watch causes mechanical vibration which is amplified by an amplifier. The resulting impulse actuates a pen which makes a characteristic mark on the revolving paper.

The complete test of a watch is made with the pendent up, pendent left or right, lying flat with the dial up and so on and the temperature is changed to 40, 60 and 90 degrees successively. The timekeeping qualities are expressed in terms of its daily rate of loss or gain.

THE R., TV & H. CROSSWORD No. 72



ACROSS

1. Electrical measuring instrument.
9. Institution of Radio Engineers (abbrev.).
10. Native Australian (abrev.).
12. Mates aerial to transmitter.
13. Photographic emulsion speed rating.
14. Stages operating in sequence.
15. Board added to finish off roof.
16. Near low-frequency end of colour spectrum.
17. Uprising.
18. French city.
20. River.
21. Speedy.
23. To steer wildly.
24. To lock receiver to incoming transmitter frequency.
26. Popular type of TV program.
32. Got up.
33. Chemically inactive.
32. Indifferent to pain or pleasure.
33. Dress material.
35. To feel unwell.
36. Amateur Transmitting Licence (colloq.).
37. Final.
38. Period of existence.

DOWN

1. Audio power ratio.
2. Lower potential mains lead.
3. Apparent valve input capacitance. (2 words).
4. Untreated metallic deposits.
5. Contact breaker using liquid metal. (2 words).
6. Voltage pressure.
7. Radio direction finding.
8. Volume reduced (2 words).
11. Short for abide.
19. Reluctance of body to change its state of rest or movement.
20. State of equality.
22. Number.
23. Legendary snow creature.
24. Pertaining to the nose.
25. Instruments of trade.
27. To cut off.
28. Slow run.
30. Yes. (Spanish).
34. Terminal

Last month's solution

M	O	D	U	L	A	T	I	O	N					J
A	I	R			S	H	R	I	E	K				U
G	L	O	W			R	E	L	E	N	T	S		
N	E	V	E	R		E				O	A	T		
E	D	I	S	O	N	E	F	F	E	C	T			
T		N	T	C		P	L	A	N	K	S			
R		G	O			H	A	N	D	S				
O			N			A	P	S	E		W			
N	O	T	C	H	E	S			D	E	A	R		
	H		E		S	E	T	S			F	E		
S	M	I	L	E	S		R	A	S	P	E	D		
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A	C	E			N		P	E	S	T	S			

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Age ..... (R.H. 460)

LET'S BUY AN ARGUMENT

(Continued from Page 103)

In television aerials, we have another variation on the theme. These aerials are normally made resonant at the incoming signal frequency and support an electrical oscillation along their length, then excited by a signal. They are, again, not dependent on earth for their operation.

Energy is withdrawn from the resonant aerial by a suitable matched line and fed to the receiver. An earth connection to the chassis is completely unnecessary, as far as the signal is concerned.

But, to get back to ordinary receivers, in fact to most ordinary radio apparatus, it is generally assumed that the chassis will be connected to earth, either directly or through a deliberate or "stray" capacitive path.

Therefore, it is assumed that anything connected to the chassis will be effectively earthed.

So what do we do? We proceed to draw circuits with numerous wires terminating on three short, parallel lines, which we accept as the earth symbol.

But don't imagine that these wires should all go to mother earth. Nothing is further from the designer's mind. They join to the metal chassis, which may or may not be specifically connected to earth.

So, more than half the time a radio technician speaks of "earth," he really means "chassis."

And, again, when he thinks of B-minus or the negative end of the high-tension supply line, he just says "earth."

One might attempt to justify this by suggesting that a metal chassis, along with sundry shields and hardware, constitutes such a bulk that it can be regarded as neutral—a kind of reservoir for electrons. And that the negative and the high-tension supply is conventionally connected to chassis, anyway.

But what happens when we encounter a transistorised portable battery set, with printed circuitry, no chassis at all, no provision for external leads and with the negative side of the battery as the business end?

There's a good chance that we'll still find an earth symbol somewhere.

A SIMPLE, RELIABLE AUDIO OSCILLATOR

(Continued from Page 43)

For those who are prepared to accept an "average" calibration, which would be sufficient for most practical purposes, we propose to make a prototype scale available to the manufacturers so that an etched panel, complete with dial, will shortly be available.

Because of limitations of space with this issue, we are unable to proceed with any detailed discussions on the various methods of calibration possible with this instrument. However, in the next isssue we plan to present such an article, together with one or two other matters of interest concerning the oscillator.

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